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A HISTORY OF PREVENTIVE MEDICINE  
HEADQUARTERS  
UNITED STATES ARMY FORCES  
MIDDLE PACIFIC

Office of The Surgeon

APO 958

HHD -Dec. 1941 - Aug. 1943  
CPA - Aug. 1943 - July 1944  
CPBC - Aug. 1944 - Sept. 1945



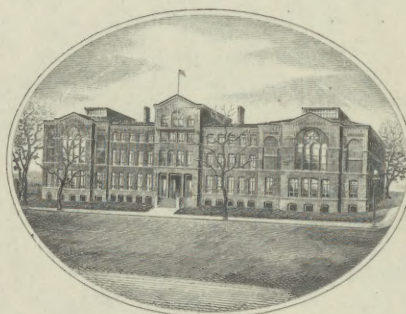
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This report is being made available pending the completion of the official History of the Medical Department in World War II. Persons finding errors in facts or important omissions should communicate with the Historical Division, Army Medical Library, Washington 25, D. C.

It is emphasized that all statistical data in this historical report are tentative and subject to revision when tabulation of individual sick and wounded report cards has been completed.



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United States Army Forces, Middle Pacific

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\* Only those chapters pertaining to History of Preventive Medicine HHD, Dec. 1941 - Aug. 1943, CPA, Aug. 1943 - July 1944, CPBC, Aug. 1944 - Sept. 1945, are reproduced in this volume. This history was compiled by members of the Surgeon's Office, CPBC.







## CHAPTER 19

### Preventive Medicine

#### Section 1

#### Preventive Medicine in the Hawaiian Department

(7 December 1941 - September 1943)

On 7 December 1941, the Hawaiian Department and the Territory of Hawaii were attacked without warning. Casualties among the military forces were heavy over a brief period of time. At the time of the attack, Army medical officers and civilian physicians were assembled in Honolulu, attending a series of lectures on traumatic surgery in order to prepare themselves for just such an emergency. Both civilian and military surgeons were readily mobilized from their place of assembly. They had previously been organized into surgical teams. Evacuation of casualties to the hospitals proceeded with marked efficiency, and all casualties were treated without delay.

During the day on 7 December, the Territory of Hawaii was placed under martial law. The Commanding General, Hawaiian Department, became the Military Governor of the Territory. Full martial law existed over the Territory until March, 1943, at which time certain civilian functions, including matters of civilian public health were returned to the civilian government.

During the period of 7 December 1941 to March, 1943, the responsibilities of the Surgeon, Hawaiian Department, were exceedingly great. He was responsible to the Military Governor of Hawaii for the investigation and determining of all factors which affected the health of civilians as well as military personnel. He was responsible for recommending and supervising measures for the control of disease, adequate nutrition, and the provision of medical care and first aid facilities for the entire Territory.

By afternoon of 7 December, almost all troops had reached their defense positions. Troops and civilians were necessarily brought into intimate contact with one another. The land mass in the Hawaiian Islands was relatively small, and every bit of it had to be defended. A great many of the troop units lacked training in field sanitation, but sanitary expediences were surprisingly well carried out, and the health of the command remained excellent.

Preventive medicine functions in the Hawaiian Department were carried out in the Medical Inspector's Office. At the onset of the war the Medical Inspector had no commissioned assistants. His work was largely carried out through close liaison with the surgeons of the various posts, the two infantry divisions, the Hawaiian Coast Artillery, the Hawaiian Air Force, and the Army Transport Service.

With the sudden onset of the war and the institution of martial law, the Medical Inspector assisted the Department Surgeon with the many immediate medical problems. Semi-permanent sanitary facilities had to be provided as rapidly as possible for the troops deployed in the field. Troop reinforcements began to arrive in large numbers from the U. S. mainland for the defense of the Territory, and military camps and medical facilities had to be expanded, particularly on the Islands of Hawaii, Maui, and Kauai. The U. S. Engineering Office hired large numbers of civilian employees and established field camps for feeding and housing them. These required much sanitary supervision. The Office of Civilian Defense required supervision, and frequent inspections were necessary to insure that adequate provision had been made for civilian evacuation, emergency housing, food and medical care in event of enemy attack or epidemics of disease. Food and water supplies had to be protected against accidental or enemy contamination. Medical facilities were inadequate to care for the military and civilian casualties which could be expected in event of enemy invasion. Both Army and civilian hospitals had to be expanded, blacked-out, and splinter proofed. Materials, supplies, and personnel for the construction and operation of hospitals became critical, and decisions as to priorities had to be made. Problems in waste disposal and mosquito and rat control developed because of labor shortages and military restrictions concerning the burning of waste. Dependents of military personnel and other civilians had to be evacuated to the mainland. Civilian Army and Navy employees began to arrive from the mainland to swell the City of Honolulu. Restaurant and rooming facilities became over-crowded, and many temporary facilities opened with inexperienced personnel and inadequate equipment. The Territorial Board of Health was unable adequately to inspect and supervise the sanitation of these establishments without assistance from the Army. Certain medical practitioners and sanitarians applied for active duty with the Army, and decisions were required as to whether these persons were more essential to the Army or the civilian medical-sanitary organization. Add to all these problems the constant expectancy of enemy attack, and a civilian population over half Japanese, among them many enemy aliens, and the complexity and magnitude of the problems which faced the Hawaiian Department Surgeon and his Medical Inspector can be appreciated.



Prior to 7 December, a number of new Army construction projects were in progress on Oahu, including Ft. Malakole and the camp which was to become Ft. Hase. Expeditions of construction workers under the U. S. Engineering Office, and supporting troops, had departed from Oahu in November to set up bases on Canton and Christmas Islands. These and other projects had been a training and testing ground in the problems of field sanitation in the subtropical Hawaiian Islands and the tropical Pacific coral atolls.<sup>1</sup>

Protection of food and water supplies became a matter of immediate importance on 7 December and thereafter. During the day of the attack there had been several reports that the water had been poisoned. These reports were investigated immediately, and in each instance were found to be false. Military guard was established over food warehouses and water systems, and steps were taken to collect all poisons which might fall into alien hands.

In January 1942, the Medical Inspector prepared a statement to the Department Surgeon in which he summarized the sanitary status of Oahu military installations.<sup>2</sup> All installations were noted to be under efficient field medical inspections. Special sanitary problems noted included mosquito breeding, disposal of civilian trash, proper air and gas proofing of the advanced echelon command post, preventive medicine among the large numbers of newly arriving Army units, proper evacuation of Army dependents, evacuation of battle casualties, and sanitary problems of garrisons on the outlying islands. The disinsectization of aircraft was apparently functioning well, smallpox and typhoid-paratyphoid vaccinations were being given without delay, and mess sanitation was improving. No active communicable disease menace was recognized, and particular attention was being given to the prevention of the enteric diseases.

In March 1942, the Medical Inspector had been assigned two commissioned assistants. This was recorded in a letter from the Department Surgeon to the Medical Inspector, dated 29 March 1942,<sup>2</sup> concerning a plan for systematic medical inspection of the command. In August, 1942, a third medical officer assistant and a Medical Administrative Corps office executive were added. The number of enlisted clerical assistants, drivers, and sanitary technicians was increased concurrently.

Several important preventive medicine functions, including venereal disease control, epidemiology, rodent control, garbage and waste disposal, and civilian liaison in sanitary matters were not directly nor entirely a responsibility of the Medical Inspector in 1942. The Surgeon, Hawaiian Coast Artillery Command, later Hawaiian

Seacost Artillery Command, was charged with responsibility for venereal disease control, sanitary aspects of large scale garbage and rubbish disposal problems, rodent control, and liaison with certain civilian organizations centering about the Honolulu Chamber of Commerce. A medical officer in the Executive Office of the Hawaiian Department Surgeon's Office was charged with supervision over the disinsectization of aircraft and the search of aircraft for insects after spraying. An officer on loan from The Surgeon General's Office in connection with defense against biological attack was used by the Department Surgeon as an epidemiological consultant. Responsibility for rodent control was placed with the Medical Inspector late in 1942, and all preventive medicine functions were consolidated under him in 1943. During 1942, the work of the Medical Inspector was largely confined to the solution of problems in general military sanitation and the training of troops in field sanitation. The Medical Inspector processed the sanitary reports, received daily reports of communicable diseases, kept records and charts of communicable disease statistics, both military and civilian, and kept close liaison with field force surgeons and the medical officers charged with special preventive medicine functions.

When troops took up field positions on 7 December, housing was almost entirely improvised. Small camouflaged one and two man shanties of waste lumber, ground excavations, or vacated civilian habitations were commonly used for shelter. Tentage was difficult to camouflage, and deteriorated rapidly from moisture. The equable climate required a minimum of shelter, and permitted adequate ventilation at all times. The Corps of Engineers designed and constructed large numbers of prefabricated portable wooden houses, 16 x 21 ft. in floor area. These buildings became standard for field housing throughout the command. They were issued on the basis of 40 sq. ft. of floor area per man.<sup>3</sup> Experience has shown this allowance to have been adequate. Upper respiratory infections have been mild and low in incidence.

Careful attention was given to the troop water supplies throughout the year of 1942. Frequent bacteriological examinations were made for potability, and chlorination was instituted where necessary. On 7 November 1942, General Order No. 154 was published by the Military Governor directing the continuous chlorination of the principal military and civilian water supplies of the Territory.<sup>4</sup> In effect, all military water was chlorinated by continuous chlorination or by hand methods. The Honolulu and suburban Oahu water systems were equipped with continuous chlorinators. These water systems supplied a number of military installations in and about Honolulu.



Extensive use was made of pit latrines as the most economical means of sewage disposal. Where sanitary or esthetic needs would not permit the use of pit latrines, cesspools and septic tanks were used. Troop installations within the limits of Honolulu were provided with flush toilet facilities, usually connected to the City sewage system, in compliance with local sanitary codes. Because of the need for conservation of materials and shipping, the use of plumbing was kept to the minimum consistent with good sanitation. Because of the importance of producing as much food locally as possible, edible portions of garbage have been disposed of by feeding to hogs. This has been accomplished by sale through Quartermaster contract, and has continued throughout the war. Non-edible garbage and rubbish has been disposed of on carefully sanitized dumps and sanitary fills. Experience gained during 1943, confirmed the dump or sanitary fill to be the most economic means of waste disposal under existing war time conditions.

No unusual difficulties occurred in fly control during 1942. Standard procedures gave satisfactory results when carefully applied. No mosquito-borne diseases were present. Mosquito control measures were pressed wherever possible without undue interference with more important work. In general, both Aedes and Culex mosquitoes were plentiful, in both military and civilian areas. The importance of seepage and rain water standing in bomb shelters as mosquito breeding places was recognized during the year, however, and corrective measures were taken. Bedbugs became a serious problem in 1942, and remained a problem until 1944. There was no entomologist assigned to the staff of the Hawaiian Department Surgeon during 1942, and there were no well organized pest control organizations set up under post utilities, the Quartermaster, or the Engineer.

Great emphasis was given to quarantine procedures in the control of communicable diseases during 1942. With the rapid expansion of the Army in the Hawaiian Islands a considerable number of cases of communicable diseases were imported from the mainland. The Department Surgeon required that the Medical Inspector be notified of every case of communicable disease taken from a transport on arrival or hospitalized on Oahu. Usually some degree of working quarantine was imposed upon the unit or immediate contacts of the case. These quarantines were frequently relaxed where there was cause from the standpoint of military expediency. An example of the action taken

in connection with a case of communicable disease is obtained from an entry in the Diary of the Medical Inspector's Office, dated 23 April 1942:

"1720: Lt. Bacchiani, 101st Sig. Bn., phoned and requested information concerning quarantine of outfit because of scarlet fever. He stated that case is one of 57 new arrivals (one week ago). About 50 of these had infected throats on arrival.

"1845: Major DuPriest and Lt. Shapiro returned from visit to 101st Sig. Bn., School St. Advice was given as to quarantine of tent mates, daily inspection of command with special care being taken with new arrivals and hospitalization of suspects.

"Lt. Col. Smock was consulted. He desired that following recommendation be put in writing by the Surgeon to Commanding Officer of 101st Sig. Bn.

'1. Absolute quarantine for tent mates of the case of scarlet fever.

'2. Working quarantine of all new men (57 less one case of scarlet fever).

'3. Inspection of people in working quarantine and taking of temperature 2 times daily.

'4. Inspection of remainder of organization living in the same area once daily, temperature of each man will be taken in A. M.

'5. All contacts showing any suspicious prodromal signs, such as sore throat, elevated temperature, etc., to be hospitalized for observation.

"Arrangements have been made with Capt. Hoagland of Provisional General Hospital #3 for the disinfection of tent and contents therein."

In May 1942, the Department Surgeon was still not satisfied with the degree of attention given to the control of communicable diseases. It is recorded in the diary of the Medical Inspector's Office, 27 May 1942, that the Surgeon charged the Medical Inspector's Office with not dealing firmly with the facts, not being sure of data, and not making full use of references. The Surgeon emphasized that preventive measures were most important at the outset, therefore it was important to get early information in event an epidemic was starting. He advised



through familiarity with the contents of Rosenau's Text on Preventive Medicine, page 667. Following this, one officer in the Medical Inspector's Office telephoned the Territorial Board of Health for civilian communicable disease reports daily, and recorded these and information concerning military cases in a daily diary. This officer was expected to keep all other officers of the Medical Inspector's Office currently informed of the status of communicable diseases in both the military and civilian populations.

Except for an outbreak of bacillary dysentery on Canton beginning in September,<sup>5</sup> there were no unusual difficulties from communicable diseases during 1942. Several small outbreaks of bacillary dysentery occurred which were quickly brought under control. These included 40 cases in an antiaircraft battery and 140 cases in an infantry company on Oahu. Of the 69 cases of malaria reported during the year, there was no evidence that any had been contracted within the Hawaiian Department. There was a moderate increase in common respiratory diseases during December, 1942 and January, 1943, with a peak incidence of 118 per thousand per annum. A large number of hepatitis cases secondary to yellow fever inoculation were not charged as communicable diseases. An outbreak of 74 cases of typhoid fever in school children secondary to a carrier working in the school cafeteria occurred during 1942. Beginning in November, 1942, the Army began to hospitalize approximately 100 civilian tuberculosis patients who were infectious to the community and could not be admitted to the limited civilian hospital facilities. The immunizations which had already been required of Hawaiian Department troops when the war began were smallpox, typhoid-paratyphoid fever, tetanus, and yellow fever. Frequent checks were made of the various units to insure compliance with immunization objectives, and reimmunization against smallpox and typhoid-paratyphoid fever was required of all military personnel who had not been so immunized during 1941. In April, 1942, all yellow fever vaccine supplied by the Laboratory of the International Health Division of the Rockefeller Foundation was destroyed, and in June 1942, the yellow fever immunization requirement for troops in the Hawaiian Department was revoked in compliance with War Department instructions. Between March and August, 1942, there occurred 4465 cases of jaundice secondary to yellow fever inoculation in the Hawaiian Department.<sup>6</sup> These jaundice cases had occurred at a time when Japanese attack was feared imminent. Because it was assumed at the beginning that the jaundice cases were cases of contagious catarrhal jaundice careful isolation procedures were carried out. Special hospitals were set up on each of the Hawaiian Islands for jaundice cases. This was considered necessary, both for proper isolation, and to clear the established hospitals in event of battle.

Vaccination of civilian Army employees against smallpox and the typhoid-paratyphoid fevers was made compulsory in December, 1941, in compliance with AR 40-215, 4 March 1940. Beginning in February 1942, smallpox and typhoid-paratyphoid immunizations were made compulsory for all civilians in the Territory of Hawaii, except where excuse had been given by a physician.<sup>7</sup> The civilian immunization program was completed during 1942, it being estimated that 86% of the population had been immunized against typhoid-paratyphoid fevers, and 88% against smallpox. These immunizations were given upon the recommendation of the Department Surgeon, and were considered justified because of the certainty of large-scale civilian evacuations to insanitated mountain valleys under conditions of great crowding had enemy attack taken place. Civilian Army employees were encouraged to take tetanus immunizations, but tetanus was not offered during the mass civilian immunizations. Parents throughout the Territory were urged to have children between the ages of 9 months and 10 years immunized against diphtheria. Immunizations were made compulsory for these children in 1943.

During the early months of 1942, considerable study was made concerning the adequacy of local food supplies.<sup>8</sup> The likelihood of an enemy invasion of the Territory with a prolonged military campaign, or of an enemy naval blockade of the Hawaiian Islands was given consideration. Study was given by the Office of Civilian Defense to the possibility of utilizing locally produced foods as sources of adequate amounts of the essential vitamins and minerals for the population. The University of Hawaii assisted in collecting data concerning the nutritional content of the various locally produced foods, also the expected production of these foods. On the basis of these studies it was considered advisable to store reserves of vitamins B and C for possible emergency use.

The Army had been placed on field ration A as of 9 December 1941. Fresh meat, fruits, and vegetables were not as abundantly provided on the field ration as they had been on the garrison ration. There was some uncertainty in the mind of the Department Surgeon as to the complete adequacy of the field ration as provided in respect to all the essential vitamins and minerals. No Sanitary Corps officer nutritionist was available to assist in the necessary analytical studies. Such studies of the ration as were made by field surgeons failed to demonstrate any inadequacy in the ration. These analyses had been made of the ration as theoretically issued, and did not consider losses due to cooking, waste, failure of rations to be drawn, or rations returned unused to Quartermaster Stocks. None of the common signs of vitamin deficiency were noted in the troops which could not



just as well have been attributed to other factors. However, because an uncertainty existed as to the adequacy of the dietary of the troops, and because it was a commonly accepted concept that certain sub-clinical vitamin deficiencies could exist affecting efficiency and morale without overt clinical signs and symptoms, the Department Surgeon considered it advisable to recommend the issue of a daily supplementary vitamin tablet to all Department military personnel. A letter containing this recommendation was sent to the Adjutant General in March, 1942. The recommendation was not given favorable consideration, pending the receipt of acceptable data showing specifically wherein the field ration was inadequate, however, a 3 months' supply of multivitamin tablets for all Department troops was approved for storage in the Department as a vitamin reserve. The storage of this vitamin reserve was accomplished during 1942 and has been maintained through the present time. Periodic determinations of the potency of these reserve vitamin stores have been made, and stock has been rotated for issue through the medical supply depot in order to maintain fresh supplies in storage. Supplementary vitamin issues have only been authorized for troops on the coral atolls and troops on duty for long periods in underground installations.

The principal problems in garbage and rubbish disposal which faced the Army in 1942 concerned civilian facilities. Many factors which developed with the war had contributed to a breakdown in the civilian waste disposal systems. The population in the City of Honolulu had greatly increased, while much of the labor formerly available to the City and County of Honolulu for the collection of garbage and rubbish had been lost to the war industries. Restrictions against the lighting of fires on private premises in connection with total black-out had prevented the burning of combustible waste by householders on their own premises. Furthermore, many civilians left home for their war jobs before daylight and returned after sunset, many of them seven days a week. City, County, and private dumps had become insanitary due to labor shortages and inadequate provisions for their burning. It was necessary for the Army to intervene and assist the civilian agencies for the common good. Furthermore, with the Army units dispersed over the Island of Oahu it was convenient for military personnel to use established civilian dumps for waste disposal. Complete study was given to these problems by representatives of the Department Surgeon and Department Engineer in liaison with the concerned civilian agencies. As a result of the study, Section II, General Order No. 122,<sup>9</sup> dated 1 July 1942, was published. This order authorized private incinerators, established regular schedules of garbage and rubbish collections and established official dumps which were to be properly burned and maintained. Other dumps were cleaned up, many by troop labor.



Only established dumps could be used. Later, General Order No. 137<sup>10</sup> was published 11 September 1942, providing for a general clean-up of all premises in Honolulu under penalty of fine. The Army provided extra trucks and prisoner labor to assist the regular collectors in removing the tons of additional waste brought to the curbstones. So great was the amount of waste to be removed that the Army extended the period of assistance from one month to six weeks. This work solved the civilian waste disposal problem to such an extent that no more assistance from the Army has been considered necessary. From time to time the City and County of Honolulu has requested that enlisted men be placed on duty as Honolulu rubbish collectors or as laborers to assist in the construction of a new incinerator, but these requests have not been approved. Some Army assistance in the removal of Aedes mosquito breeding rubbish was given during 1943-45 in connection with the Aedes mosquito control program.

The same factors which forced the Army to assist in civilian waste disposal problems lead to Army support of the Bureau of Sanitation of the Territorial Board of Health. Beginning in September, 1942, the Army provided approximately 30 trained sanitary technicians for work as sanitary inspectors of restaurants and rooming houses, and as technicians in Board of Health laboratories. For the duration of full martial law the work of the enlisted inspectors was most effective. Proprietors of insanitary establishments were fined heavily by the provost courts, and the sanitation in the City of Honolulu improved greatly to the benefit of war workers and service personnel on pass. Although the number of these enlisted sanitary inspectors has been repeatedly reduced, approximately ten were still assigned to this work in September 1945.

An Army disinsectization service for military aircraft arriving from outside the Territory of Hawaii had been organized prior to 7 December 1941 with the approval of the War Department. The disinsectization of aircraft in peace time is a function of the U. S. Public Health Service. However, the increasing number of military flights, the necessity for secrecy, and the uncertainty of the time of arrival of aircraft precluded the continuation of this function by the U. S. Public Health Service. Just prior to 7 December 1941, War Department approval was further obtained for the substitution of an Army quarantine inspection service for the inspections of the U. S. Public Health Service and the U. S. Department of Agriculture. With the establishment of martial law over the Territory, General Order No. 77 was<sup>11</sup> published designating the Surgeon, Hickam Field, as the Air Quarantine Officer to accomplish these inspections. Later in June, 1942, the Commanding General, Hawaiian Department, designated the senior medical officers of all Hawaiian Department airfields as quarantine officers for their respective fields, and instructions for quarantine officers were published. In May, 1942, the



Department Surgeon had designated a medical officer on his staff to institute a program of inspection of aircraft arriving at Hickam Field from outside the Territory for check on the efficiency of disinsectization, and for collection of all insects found in the aircraft, dead or alive, for identification. The identifications were made by entomologists of the Hawaiian Sugar Planters' Association. This program of collection and identification of insects arriving in the Territory on Army aircraft has continued to a partial extent to the present time, and files of these identifications are available in the files of the Department Surgeon. In October 1942, the representative of the Department Surgeon in connection with the disinsectization of aircraft worked with an officer of the District Medical Office, 14th Naval District, to assist the Navy in organizing a disinsectization program similar to that carried on by the Army.

The venereal disease rate for the Hawaiian Department in 1941 had been 14.1. During 1942, it declined to 9.6. During the first 5 months of 1942, control measures had followed the established policies, including education, operation of a number of prophylactic stations, monthly physical inspections, and reporting of information concerning probable sources of infection to the Military Police. Early in 1942, a very competent venereal disease control officer was appointed by the Department Surgeon. This officer in cooperation with the Director of the Venereal Disease Control Division of the Territorial Board of Health made a very thorough study of factors affecting the incidence of venereal diseases in the command. Many aspects of the situation in Hawaii were unique. A system of organized prostitution existed in the Territory. Houses of prostitution had attending physicians who examined the operators at regular intervals. Some of these "house physicians" were physicians of high professional ability, and the practice was lucrative. There was a great excess of males over females in the community. Large numbers of troops and single male laborers were being added to the wartime population. There was a curfew and a blackout, moderate prohibition, and the entire civilian population had been registered and finger printed. Travel between the Hawaiian Islands and between the Hawaiian Islands and the U. S. mainland was under absolute control. There were strong forces in the civilian community favoring the presence of organized prostitution. These forces included both a large group who obtained handsome financial support from a reportedly "\$10,000,000 business," and others who felt that the prostitution system had contributed to the low venereal disease incidence in the islands and was a protection to the respectable women and girls of the community. An excellent statement of the case of the latter group was contained in an article entitled "A Bedtime Story."<sup>12</sup> Considerable thought was

given to the possibility of closing the houses of prostitution. Venereal disease rates were not such that it could be shown that prostitution affected adversely the health of troops in the Hawaiian Department. To the contrary, venereal disease rates in the Hawaiian Department were approximately one quarter those for the Army on the U.S. mainland. There was some concern as to what effect the closing of houses of prostitution might have upon the large community of single males, under stress of hard work, wartime conditions, blackout and curfew, and whether an increase in sex crimes might result from such action. Although an order by the Military Governor would have been all that would have been required to abolish organized prostitution in the Territory, no such action was taken. The course taken by the Army toward the control of venereal diseases in 1942, took the form of a vigorous program of prophylaxes, case finding, and thorough treatments. On 21 May 1942, the office of the Military Governor issued General Order No. 197, Section I of which outlines the control of communicable disease in the Territory of Hawaii and which applied particularly to the control of venereal diseases.<sup>13</sup> Venereal disease control activities under the provisions of General Order No. 107 were as follows:

Reporting by special messenger, to the Territorial Board of Health, by both military and civilian physicians all contacts within 24 hours after diagnosis of a case of venereal disease. The Territorial Board of Health energetically followed up all of the contact reports, and, as a result, large numbers of infected women and men were quickly placed under treatment.

An intensive drive was carried out by both military and civilian police in the pick-up and examination of all "street walkers" to determine whether or not they were diseased.

Hospitalization was provided under military control for all recalcitrant persons who did not take adequate treatment, for prostitutes found infected who had not been reported by their private physicians or those found infected after having been pronounced cured by their private physicians, and for "street walkers". In December, 1942, arrangements were completed for the hospitalization of all prostitutes found infected.

An extensive educational program was carried out. Four well equipped prophylactic stations were operated in Honolulu, and one in Wahiawa. As many as 50,000 prophylactic treatments a month were given in these Army stations.

Beginning in October, 1942, and extending through the spring of 1943, an outbreak of bacillary dysentery occurred on



Canton Island.<sup>14</sup> This outbreak was of a serious nature, considering the large proportion of the command affected, the strategical importance of the island as an airbase on the route to Australia, and the close proximity of strong Japanese bases in the Gilbert Islands. An excess of 400 cases of bacillary dysentery were diagnosed by stool culture during the course of the outbreak, and many other cases had the symptoms of dysentery but positive stool cultures were not obtained. Before adequate control measures had been taken a large number of dysentery carriers had been built up. Difficulty had been experienced in the construction of pit latrines because of the sandy nature of the terrain. Flies were prevalent. The ground water which had been pumped for bathing purposes was found to be heavily contaminated because of the numerous pit latrines and pervious nature of the soil. Sanitary deficiencies were corrected, but progress against the disease was not made until a laboratory team was sent to Canton Island to take rectal swab stool cultures of all personnel for the detection and treatment of carriers. Sulfaguanidine was used for the treatment of cases and known carriers with satisfactory results. Following this outbreak all personnel arriving and departing from assignment to the Canton Island garrison were checked by rectal swab stool culture for bacillary dysentery infection. This procedure was discontinued in September, 1943.

The year 1943 marked the turning point in the war in the Pacific. The Japanese had been soundly beaten away from their threat against Midway and the Hawaiian Islands in June, 1942. In early 1943, the Japanese were being beaten and driven out of Guadalcanal. Troops staged and trained in the Hawaiian Department (24th Infantry Division) played a large role in the successful outcome of the Guadalcanal battle. During 1943, three more Infantry Divisions (the 6th, 24th, and 40th) were staged and trained in the Hawaiian Department and forwarded to participate in the offensives of the Southwest Pacific area. Concurrently with these activities the Medical Inspector's Office, Hawaiian Department was expanded to cope with the greater tasks. For the first time in 1943, the allowances of personnel for the Medical Inspector's Office became sufficient, and all preventive medicine functions were consolidated under it.<sup>15</sup>

During January, 1943, the personnel of the Medical Inspector's Office consisted of five officers, one warrant officer, and three noncommissioned officers. Most of the activities of the month consisted of routine inspections of units, investigations of contagious diseases, investigations of sanitary deficiencies reported by subordinate units, and cooperation with general and special staff sections, as well as with responsible civilian agencies, to bring about correction of sanitary deficiencies. Close cooperation was

maintained with the Department Engineer in all matters of construction in which sanitary or other medical considerations were involved. Inspections were made of all hospitals and fixed dispensaries on Oahu to determine the status of medical supplies. Attention was given to amounts of equipment on hand, the method of storage, and whether or not deterioration was occurring due to improper storage or excessive inventories. A survey was made of all civilian hog raisers who were collecting Army garbage, and an index of names and locations was made.

During January and February, 1943, a rodent control school was conducted by a member of the Medical Inspector's Office for officers and enlisted men of the various organizations in the Department. During the latter half of 1942, there had occurred 16 cases of endemic typhus among military personnel. Inspections of military posts and camps had shown considerable infestation with rats. During 1942, the Medical Inspector had trained 16 enlisted technicians to carry out rodent control measures on Oahu. By December, 1942, it had become obvious that no central rat control team could carry on rat control for all the troops. The only practical solution to the problem was the organization of a rat control detail for each Army unit, including companies. A letter, subject: Rat Control, dated 12 December 1942, had been prepared in the Medical Inspector's Office and published by the Commanding General.<sup>16</sup> The rodent control school was conducted in accordance with this letter. A three day course was attended by a total of 45 officers, and a two weeks course was held for 97 enlisted men. These students returned to their organizations where they formed a nucleus for training more men within their units. It was required that all rats caught or found dead be forwarded to an island plague laboratory for examination.

During February, 1943, the pit latrines at Canton Island were replaced by impervious concrete vaults. A truck mounted cesspool tank had been sent to Canton Island for periodic emptying of the vaults, and the sewage was being disposed of through a pipe line running offshore. Search for a practical expedient for bedbug control continued. Methyl bromide was not considered practical for use on a large scale. Studies on the use of chlorpicrin and other fumigants were begun.

In March, 1943, two medical officers were placed on temporary duty with the Medical Inspector's Office for the purpose of making a detailed study of the diet of the troops of the Department. A report of this study was made in an unpublished letter, File 430, subject: Analysis as to Dietary Adequacy of the Field Ration, Hawaiian Department.<sup>17</sup> The conclusions reached at the conclusion of



the study were that no dietary inadequacies existed. In retrospect, however, it appears that although the analyses were made in a most careful and systematic way, they were made of the theoretical Quartermaster issue, and not of the actual issue from the depots. No corrections were made for cooking losses or waste. The average caloric intake per man per day was calculated to be over 5000 calories.

Other activities of the Medical Inspector's Office during March 1943, included sanitary inspections of all U.S. Engineering Department messes. The medical inspector of the 24th Division was accompanied on an inspection of all units of the division. A practical mosquito repellent ointment containing oil of citronella was improvised for incorporation in an individual medical jungle kit. This jungle kit was being made up by the medical supply section for troops being forwarded to the South Pacific area.<sup>18</sup> A new study was made of the water-sheds of the Koolau mountain range on Oahu, and a map was prepared showing all the water-shed areas. This map was published as part of a directive prohibiting the use of water-sheds by troops for bivouac or training except with the specific permission of Hq. Hawaiian Department.<sup>19</sup>

During March, 1943, two fatal cases of plague occurred among civilians in the Hamakua District of Hawaii, the first since 1939. An increasing number of cases of rodent plague was being found in this area; an increasing proportion of these cases in the more domestic species of rats and closer to human habitations. A letter was prepared by the Medical Inspector's Office for the Commanding General's signature, requesting the Civil Governor to intensify rat control measures in the Hamakua District. The establishment of a rodent plague laboratory on the Island of Kauai was studied. The Territorial Board of Health had not maintained one on that island.

On 1 April 1943, a commissioned entomologist was assigned to the Medical Inspector's staff. A comprehensive mosquito survey of the Ft. Shafter - Hickam Field - Pearl Harbor areas was instituted without delay. Six enlisted sanitary technicians were trained to assist the entomologist in this work. All mosquito breeding places found in this area were noted and mosquito catches identified. It had been assumed that had Anopheles mosquitoes been introduced to Oahu by aircraft from South Pacific Islands they would most likely be found in the vicinity of Hickam Field and Pearl Harbor. No foreign species of mosquitoes were found, but it was noted that more mosquito breeding existed on military than on civilian properties. A directive to the troops concerning mosquito control was

prepared and published as Section V, HHD Circular No. 75, 8 June 1943.

A study was made of the plague control activities of the Territorial Board of Health on Maui and Hawaii, following which a letter was prepared for the signature of the Military Governor to the Civil Governor requesting that 85 additional men be employed for rodent control in the Hamakua District.<sup>20</sup> There was always the contingency that plague infected rats might reach Oahu from the Island of Hawaii in shipping. Civilian, military, and naval agencies concerned were contacted informally with a view to increasing the use of rat guards on the mooring lines of ships in Territorial harbors as required by Board of Health regulations. Periodic checks were made by inspectors from the Medical Inspector's Office to determine the number of ships using rat guards.<sup>21</sup>

Other activities during the month of April, 1943, included publication to all commanding officers of a letter, subject: Poliomyelitis (infantile paralysis).<sup>22</sup> An outbreak of poliomyelitis was occurring among the civilian population in Honolulu at the time. The letter contained available information concerning the disease and possible means of protecting the troops from infection with it. Letters were sent to all hospital commanders enjoining them to curtail nose and throat surgery until the outbreak of poliomyelitis had subsided. The incidence of new cases of the disease was watched daily and plotted on a map. There was a total of 74 cases of poliomyelitis during the outbreak, of which only 4 were among military personnel.

With the arrival of numbers of military personnel to the Hawaiian Islands from areas in which dengue fever was endemic it was felt that special precautions should be taken to prevent the introduction of dengue to the Department. Accordingly a publication was prepared concerning the clinical aspects and mode of transmission of dengue fever. This was sent to all medical officers as a letter, subject: Dengue, dated 1 May 1943.<sup>23</sup> The publication of this letter preceded the introduction of dengue to Oahu through civilian channels by approximately three months. The letter stimulated greater effort toward mosquito control in military areas, but it is doubtful if the average medical officer was sufficiently familiar with mosquitoes to distinguish between the Aedes and Culex species. No mosquito control program existed for civilian areas, particularly Honolulu and Waikiki where so many military personnel congregated on pass. This letter showed a remarkable appreciation of the clinical and epidemiological characteristics of the disease. It was directed that all patients with fever be suspected and screened, and that a careful



history be taken from all such patients as to previous movements and intervals involved. Little emphasis was given to the classical clinical description of dengue.

In May, 1943, chlorpicrin was used experimentally for bedbug control by personnel of the Medical Inspector's Office, and demonstrations were given to major echelon surgeons of the command. Chlorpicrin proved to be a safe and satisfactory procedure for bedbug eradication in barracks for small units, but was not so satisfactorily applicable to large buildings because of its cost and difficulty in procurement.

Study of the Honolulu sewage disposal system for the lower Kalihi area was continued, with the object of assisting the civilian authorities to improve the system. Ft. Shafter and Tripler General Hospital sewage was pumped into this system, and the increased military strength on these posts, plus the pouring into the system of increased industrial wastes from the Honolulu area had caused frequent over-flowing of sewage in lower Kalihi civilian areas. The commanding officer of a Ranger training school at Schofield Barracks had dammed up a stream which carried gutter and other waste waters from the post in order to create a ranger training pool into which he could have his students plunge fully uniformed and equipped from a high tower. This water was found to be highly contaminated with B. coli, but it appeared for a matter of several weeks that the Medical Inspector had met his match in the chief of the Rangers who believed that blood and guts and a strong constitution would cover many sanitary deficiencies. Eventually, corrective action was accomplished. Surveys were made of the bivouacs of military detachments within the Oahu watersheds, in order to insure that sufficient sanitary precautions would be taken to protect the water supplies. Many changes in construction of the Waianae-Kai Military Reservation were recommended to the Department Engineer. The original construction had many inherent sanitary defects. Among the changes that were gradually being accomplished was screening of kitchen and mess halls. A civilian dump and large open civilian cesspool in the town of Waianae had been a periodic sanitary nuisance productive of flies and Culex mosquitoes.

A final report concerning the bacillary dysentery epidemic on Canton Island was forwarded to The Surgeon General during the month of June, 1943.<sup>14</sup> The control measures which had been taken had proved to be effective, and the epidemic had subsided. There had been nothing new or unusual about this epidemic. The island commander had not given sufficient command attention to

sanitation. Extensive fly breeding had taken place in latrines, garbage, and around kitchen areas where waste water had been dumped. Flies were numerous, and kitchens and mess halls had not been protected from flies. Mess kits washing facilities were not properly maintained. An exceptionally competent officer had been sent to Canton Island with a laboratory team. Sanitation was greatly improved, and concurrently thousands of stool cultures were taken and dysentery carriers found were isolated and treated with sulfaguanidine until proved noninfectious by stool culture. A paper concerning this epidemic and its control was written by Major James E. Weiss, Sn. C., and Capt. Wilmore B. Finerman, M.C., and submitted to The Surgeon General for publication during November 1943.<sup>24</sup>

In June 1943, the Medical Inspector acted upon a memorandum from the Department Engineer to the effect that inadequately treated sewage from Army installations was polluting several streams on Oahu. Complete surveys were made in cooperation with the Engineer, and necessary corrective measures were subsequently instituted. One particularly serious sanitary deficiency was noted where untreated sewage from an antiaircraft bivouac was being discharged into a stream flooding civilian watercress gardens supplying half the Oahu markets. This discharge of sewage was stopped at once, and provisions were made whereby the sewage was retained in a septic tank and periodically removed by truck. In other instances where food supplies were not being contaminated, provisions were made for adequate chlorination of sewage before discharge. One sanitary problem in connection with these streams of chlorinated sewage effluent on Oahu has been heavy Culex mosquito breeding where the water flow has not been sufficiently rapid or turbulent. The rapid growth of thick, matted, coarse grass along the miles of stream banks through inaccessible places has made continuous mosquito control difficult. Should it be possible in the post war period to survey and determine all areas in which mosquito breeding is prone to occur in these streams, a mosquito control program utilizing DDT may be a relatively easy matter.

A study of progress in rodent control since the rodent control school had been conducted in January and February, 1943, showed that between 12,000 to 15,000 rats were being killed by poisoning per month, and that effective rat proofing and other general control measures were being carried out on a wide scale in military organizations.<sup>25</sup> A laboratory officer and an enlisted technician were sent from a station hospital on Kauai for training at the Territorial plague laboratory on the Island of Hawaii, preparatory to the establishment of an Army rodent plague laboratory on Kauai (this laboratory began to check for evidence of rodent plague on Kauai in August).



A cold storage plant at Schofield Barracks, and several Quartermaster warehouses at Ft. Kamehameha were found to be rat infested, and necessary rat proofing construction was accomplished.

Attention was given to several fly control problems about military areas in Honolulu. In upper Kalihi Valley one Quartermaster camp was infested with flies from an unauthorized dump on a civilian premise. This was easily corrected through cooperation with the Territorial Board of Health. Fly problems in Quartermaster camps in lower Kalihi area were much more difficult. In this vicinity there existed at least 5 piggeries and 3 large poultry farms, in addition to the auxiliary City Dump. Movement of the military camps was impractical. Sanitary conditions were gradually improved through a program of regular inspections and education carried on by inspectors of the Territorial Board of Health.

Other activities of the Medical Inspector's Office during June, 1943, included conferences in connection with the organization of a permanent rodent and vermin control detail at Schofield Barracks under the Engineers, and the conversion of available Engineer equipment for bedbug control procedures. No immediate progress was made. Bedbugs continued to be prevalent. Severe infestations were found at Ft. Ruger, Bellows Field, and Kahuku Air Base, and recommendations were made to local surgeons and commanding officers concerning bedbug control measures.

Drainage and waste water disposal problems in the large Tent City area of Schofield Barracks were studied, and corrective action was taken including provision of sinks for the kitchens, grease traps, and an extension of the post sewage system to serve this area. A sanitary inspection of the large Schofield Barracks Reception Center was made, and sanitary deficiencies existing in kitchens and shower rooms were corrected.

Toward the end of June 1943, the Territorial Board of Health reported a high incidence of upper respiratory infections presumed to be influenza. The Army common respiratory disease rates showed a rise from 71 per thousand per annum in May to 96 in July, but quickly subsided to previous levels in August.

In July 1943, several difficult problems and large amounts of routine work faced the Medical Inspector. Serious sanitary deficiencies again existed in connection with the Kalihi sewage system. Complete study was given to the problem in cooperation with the Engineer and civilian authorities. Large quantities of industrial wastes were being discharged into the sewer, and the system repeatedly

overflowed through manholes in lower Kalihi civilian areas. Pumps which moved this sewage across the city to an outfall near Ft. Armstrong were worn out and sewer lines were so old that they could not withstand greater pump pressure. Additional industrial wastes were being poured into Kalihi Stream and were being backed up into the City by the tides creating disagreeable odors. A letter was prepared for the Commanding General's signature, to the Civil Governor, requesting him to take prompt action to obtain a solution to the problem, and stating that the Army would contribute a just proportion of the expense.

During this time a series of conferences on quarantine were begun with the Department Veterinarian and Quarantine Director U. S. Public Health Service, with a view to correlating all existing quarantine regulations, Army, Navy, Federal, and Territorial. Frequent inspections were made of new staging areas being constructed by the Engineer at Schofield Barracks, Kahuku, the Pali, Ft. Hase, and Waimanalo. These camps were being prepared for the reception of divisional combat teams which were to train and stage on Oahu. The sanitary aspects of new construction were studied, and changes in construction recommended. Ten cases of endemic typhus fever occurred within the Department during the month of June, seven of these in one infantry division. A 10 day course in rat control was given to selected personnel of this division, and assistance was given to two other divisions in instituting better rodent control programs. Rodent control inspections were made throughout the command, and recommendations were made where indicated.

During the month of August, 1943, practically all other activities of the Medical Inspector's Office were subordinated to the control of dengue fever. On 6 August, the Territorial Board of Health reported that 4 cases of dengue had been diagnosed among civilians ill in Waikiki. The disease had apparently been present since the middle of July. Dengue fever had not occurred in the Territory since 1913. Widespread outbreaks had occurred in Oahu in that year, and previously in 1903. Experiences with dengue fever in the United States and in the Philippines were indicative of how paralyzing this disease might be to a busy wartime community. Representatives of the Medical Inspector visited the reported cases and confirmed the diagnosis. Inspections were made for mosquito breeding on Ft. DeRussy (in the Waikiki area), and assistance was given in mosquito control. A letter was sent to the commanding officers of all Army hospitals directing them to screen all cases of fever of undetermined origin, and to notify the Department Surgeon's Office of all cases of dengue hospitalized.<sup>26</sup> By 8 August, so many cases of dengue had been reported in the Waikiki area that it was considered advisable to recommend placing personnel at Ft. DeRussy on a



working quarantine and the Ft. DeRussy-Waikiki area off-limits to other military personnel.<sup>27</sup> A letter was prepared for the signature of the Commanding General, was approved, and was forwarded to the Department Special Service Officer directing him to close the Department Recreation Center at Ft. DeRussy and the Willard Inn (recreation center for Army officers in Waikiki). The Territorial Board of Health had taken immediate action to control the outbreak in Waikiki. In addition to Board of Health inspectors, the Honolulu Chamber of Commerce provided 9 inspectors from their rat and mosquito control squad, and employed 24 additional personnel to assist. The Army provided five enlisted technicians. These men worked as a mosquito inspecting crew covering Waikiki section by section. However, the adult mosquito population had become infected and could not be controlled in this way. Upon the recommendation of the Department Surgeon, a demonstration of the use of power spraying equipment of the Chemical Warfare Service for exterior spraying of insecticide was arranged on 9 August. The Army offered the loan of this equipment to the Board of Health, and it was accepted. All supplies of suitable insecticides in Honolulu were mobilized, and all premises in Waikiki were systematically sprayed by Chemical Warfare Service teams during the remaining days of August. Upon request for assistance by the Territorial Board of Health, the U.S. Public Health Service sent a commissioned engineer and entomologist experienced in Aedes mosquito control to the Territory by air transportation. These officers arrived about 1 September. In the meantime, the Army accomplished Aedes mosquito control in all military areas and their immediate surroundings including all U. S. Engineering Department base yards. Commanding officers of the military garrisons on the other islands were notified of the epidemic and directed to take preventive measures.<sup>28</sup> An Army epidemiologist was made available to the Board of Health. One hundred mosquito bars and 12 insecticide hand sprayers were loaned to the Board of Health for distribution to civilian cases in their homes. Four trucks were loaned on 21 August. By 1 September, 148 cases of dengue had been reported, many scattered throughout Honolulu, thereby ending all hope of confining the epidemic to the Waikiki district and making it essential to inaugurate a city-wide Aedes mosquito control program at once. With the spread of dengue cases into other areas of Honolulu, and marked reduction of cases in Waikiki, the area placed off limits for military personnel in Waikiki was reduced. Restricted zones were established in other areas of Honolulu where epidemiological evidence indicated the disease had shifted.

While the dengue outbreak was attracting the major attention, the fight against plague in the Hamakua District of Hawaii was continuing. On 3 September 1943, the Office of Civilian Defense, which

had been supporting 30 plague control workers on Maui and Hawaii, announced through the Territorial Board of Health that it could not continue this support much longer. A letter was sent to the Adjutant General, Washington, D. C., dated 17 September 1943, subject: Plague in the Hawaiian Islands, requesting that the Department of the Interior be requested to furnish assistance to the Territory for plague control work.<sup>29</sup>

In mid-September 1943, the Hawaiian Department was redesignated Hqs. USAFICPA. Reorganization and expansion of the Medical Inspector's Office took place. With the reorganization, activity was geared for the offensive. However, many domestic problems remained over from the Hawaiian Department, the chief among them being control of the dengue epidemic, solution of quarantine problems, plague control on Hawaii, Aedes mosquito control for all the islands, and institution of an industrial hygiene program.



## Section 2

### Preventive Medicine in USAFICPA

(September 1943-July 1944)

The Medical Inspector's Office, Hq USAFICPA, consisted of ten officers and the necessary enlisted assistants. The duties of the officers were generally divided as follows: Medical Inspector, Assistant Medical Inspector, Venereal Disease Control Officer, Assistant Venereal Disease Control Officer, Entomologist and Rodent Control Officer, Assistant Entomologist, Epidemiologist and Medical Intelligence Officer, Assistant Epidemiologist, Industrial Hygiene Engineer, and Sanitary Engineer. All officers acted together in a coordinated program, however, and assisted one another in whatever aspects of the preventive medicine program were of the greatest importance at any one time. Subdivisions of activity were not rigid. One or more of the members of the office was frequently absent on special missions and inspection trips. At one time in early 1944, the two entomologists were participating in the Kwajalein Campaign, the Epidemiologist was absent conducting the malaria control training program, the Assistant Epidemiologist was actively engaged with the Territorial Board of Health in bringing dengue fever under control, and the Assistant Venereal Disease Control Officer was inspecting dispensaries and battalion aid stations for quality of professional service.

In September 1943, considerable attention was given to the collection of medical and sanitary data concerning the Gilbert and Ellice Islands and the Japanese Mandated Islands.<sup>30</sup> A large amount of source material was available through the Bishop Museum, the University of Hawaii, the Honolulu County Medical Society Library, and the Pacific Institute. Data was collected and recorded by island groups and by specific islands, as much as possible. Plans were made for the necessary sanitary and medical preparations to be taken for the coming campaigns. These studies were completed before the corresponding War Department Technical Bulletins concerning medical and sanitary data on these islands were received in this theater. The results of the local and the War Department studies correlated closely.

The initial Essential Technical Medical Data Report for this theater was submitted during September 1943, and monthly reports were submitted without exception thereafter.

The control of dengue fever in Honolulu continued to require the greater part of the effort of the Medical Inspector's Office. On 18 September, an additional 50 enlisted men were assigned to duty with the Board of Health for the Aedes mosquito control program. Through the remaining months of 1943, the early months of 1944, the number of Army enlisted men provided for the support of the program steadily increased, until in May 1944, a maximum of 148 enlisted personnel were on Aedes control duty in Honolulu alone. The peak of dengue fever incidence in Honolulu occurred during October, 1943. Thereafter, steady progress was made until January 1944, when during a one week period no cases occurred.

A temporary increase in dengue incidence occurred during February and March, but the epidemic was definitely broken during April. A factor contributing to the increased incidence of the disease in early 1944, was increased rainfall with resulting increased Aedes breeding indices. During the period from September, 1943, through January 1944, the full time of an officer of the Medical Inspector's Office, was made available to the Territorial Board of Health. Thereafter, only part time was necessary. Further details of the dengue fever outbreak are contained in the chapter on arthropod-borne diseases and its inclosures.<sup>31</sup>

Other activities of the Medical Inspector's Office, Hq USAFICPA during September 1943, included preparation of a master plan for Aedes mosquito control programs in any area of CPA, preparation of an order requiring yellow fever vaccination for all personnel in CPA, inspections and recommendations concerning rodent control in the plague area on Maui where construction of two new military camps was anticipated, and preparation of a letter showing the incidence of endemic typhus fever in the Territory for representatives of the United States of America Typhus Commission. Industrial hygiene activities were being rapidly developed. For a full description of these activities see Chapter 39 of this history on industrial health.

The requirement of yellow fever vaccination for all personnel in CPA<sup>32</sup> was established upon the urgent request of the Assistant Secretary of War. It was not the firm conviction of the Surgeon, CPA, nor of the Medical Inspector that this vaccination was necessary, but it gave security against the possibility that yellow fever virus might be introduced and adversely affect the military effort.

During October 1943, continued effort was given to the suppression of dengue fever. The rodent plague laboratory on Kauai submitted an initial monthly report of activities, supplies were



increased for its operation, and a system of reporting rodents examined by geographical areas was worked out with the local senior surgeons. The current practices in the application of quarantine procedures in the Territory were codified, and a summary of responsibilities charged by law to the various civilian quarantine agencies was prepared. Arrangements were made for a conference of all parties interested in quarantine, to take place in November. Reply was received from The Adjutant General, Washington, D.C., to the effect that The Surgeon General was contacting the U. S. Public Health Service and the Department of the Interior with a view to increasing assistance to the civilian authorities in carrying out plague control in the Territory. Rat control schools were conducted for selected enlisted men of an infantry division and the Army Port and Service Command. Assistance was given to the Surgeons of nine different military posts in the improvement of mosquito control programs. Plans for a special economy type water-borne latrine were received from the Engineer and forwarded in Essential Technical Medical Data.

During September, a military expedition had been sent to build an airbase on Baker Island preparatory for the campaign in the Gilbert Islands. No enemy opposition was found at Baker Island, but the surf made landings extremely difficult, and the construction of sanitary facilities was delayed. An outbreak of bacillary dysentery spread rapidly through the entire island garrison during October. On 25 October, a laboratory team was sent to Baker Island to institute stool cultures as had been done earlier on Canton Island. With improvement of sanitation, control of flies, and isolation and treatment of carriers the epidemic was brought under control. Sulfaguanidine in doses of 10 gms daily was used for the treatment of detected carriers on an ambulatory basis but the number of drug reactions which resulted was high.

On 1 November 1943, the meeting on quarantine procedures was held at the Office of the Military Governor. Representatives of the Surgeons Office, Hq USAFICPA, the Office of the Military Governor, the District Medical Office of the 14th Naval District, the U.S. Public Health Service, the Bureau of Animal Industry and the Plant Quarantine Office of the U. S. Department of Agriculture, and the Territorial Board of Agriculture and Forestry attended. All parties were given an opportunity to express their views as to what corrective action they thought should be taken by the Armed Forces to improve quarantine procedures in their respective spheres. The meeting was quite a satisfactory one, and the draft of a new Army quarantine directive was approved. This draft of this proposed quarantine directive was then forwarded to the Commanding Generals

of the Army Port and Service Command, the 7th Air Force, and the Army Transport Command for comments or approval.

Numerous inspections of new regimental and battalion combat training camps were made during November. A major problem developed in the control of fly breeding in the large pit latrines which had been constructed for these camps. Recommendations were made for correction of deficiencies in flyproofing of pits and latrine houses. On 16 November, a conference was held in the Surgeon's Office, CPA, attended by the Medical Inspector, G-1, G-3, and G-4, CPA, and representatives of the Department Reserve, Army Port and Service Command, and four infantry divisions with a view to improving the sanitation of these camps. No provision had been made for station complements for them, their maintenance having been left to the organizations occupying them for training. It was agreed that an officer should be provided for each camp for supervisory custodial and maintenance purposes, and that a survey of existing camps be made by the Engineer and Surgeon, CPA, with a view to determining and correcting any major sanitary faults existing at the camps. Experiments were set up to test the effectiveness of borax and a new chemical, paradichlorobenzene for fly control in the pit latrines.

Other problems and activities included spot checking of the first aid applied in fracture cases, testing of flame throwers and shotguns as rat control expedients for tree nesting rats, experimentation with yeast cultures in pit latrines, recommending a new sewage system for the station hospital on Maui, and study of the possible danger of evacuating military personnel infected with filariasis from the South Pacific Islands through Oahu where a large Culex mosquito population existed. The danger of introducing filariasis to the Territory of Hawaii through these military personnel was determined to be negligible. None showed circulating microfilaria in the blood. Many Samoans infected with filariasis had been brought to live in the Territory as laborers in the past, and the disease had never spread. Samoans with microfilaria in the blood were found in certain communities on Oahu but no disease was found among their children who had never been to Samoa but who had lived with their parents on Oahu in mosquito infested communities for as long as 20 years. No microfilaria were found in Samoans on Oahu who had not visited Samoa for over 8 years. Attempts at experimental infection of local Culex and Aedes mosquitoes from these natives repeatedly failed, it was believed because the numbers of microfilaria per cubic centimeter of blood in most of them had fallen to low levels.<sup>33</sup>



During the last week of November 1943, an outbreak of bacillary dysentery developed in several regiments of an infantry division conducting extensive field exercises on certain coral wastelands on Oahu. Prompt control measures were undertaken, including emphasis on proper sanitation. Stool cultures were taken of all personnel in affected units, and carriers were isolated and treated. This outbreak served as an important training lesson in sanitation for this division which subsequently assaulted and captured the southern islands of Kwajalein Atoll with a minimum of diarrhea, the first Pacific Island occupation in which dysentery was not a major problem.

During December, numerous conferences were held with the Navy because of reports of exceedingly poor sanitation in the recently captured Gilbert Islands.

In January<sup>34</sup> 1944, numerous conferences were held with the staffs of the 5th Amphibious Corps, Navy, Army assault and garrison forces to prepare them for sanitary problems which were anticipated in the projected Flintlock Operation. At this time a method was developed whereby sodium arsenite could be used to treat the dead prior to burial so as to prevent flybreeding.<sup>35</sup>

Concern was felt regarding the importation of various diseases by incoming personnel. Responsibility for insuring adequate quarantine of incoming personnel was placed on the Commanding Officer, Army Port and Service Command and the Air Quarantine Officer. Troops arriving from forward areas were no longer allowed to disembark until cleared by the Office of the Medical Inspector. Representatives of the above office were detailed to meet all ships bringing in returning task force troops.

Considerable emphasis was placed on training the three Sanitary Companies (715th, 717th, and 719th) stationed on Oahu. Intensive training in mosquito control was undertaken by the 715th and 717th Sanitary Companies, and in rodent control by the 719th. This served a dual purpose. It aided materially local control activities and was an important factor in preparing these organizations for duties elsewhere. Likewise a malarial training program for divisions was worked out and put into effect.

During the month of February arrangements were made with the Air Transport Command Headquarters for the handling of their Sanitary Reports by the Medical Inspector's Office. Mosquito surveys of rural areas on the Hawaiian Islands were completed and control units assigned for corrective work. Rat control units

were assigned to various posts. Methods of plane disinsection were studied with Air Force Officers and improvements made in the methods in current use.

A representative of the Medical Inspector's Office was with the Flintlock Operation to supervise sanitary measures, particularly the treatment of the dead prior to burial.

In March the extensive study of medical and sanitary data on Micronesia was completed and published.<sup>30</sup> Arrangements were made for the Army to establish and temporarily operate a bacteriology laboratory for study of plague at Hamaka, Hawaii. Mosquito and rodent control work continued. Arrangements were made for the hospitalization of all known cases of filariasis coming to these islands. This would afford an opportunity for studying this disease under local conditions. Because of the arrival of increasing numbers of Negro troops with an appreciable higher prevalence of venereal disease than that for white troops, special attention was given them and spinal fluid studies made.

In April 1944, continued attention was given to the problem of burial of the dead and particularly to the advantageous use of sodium arsenite in this work. Studies and recommendations were completed on the use of respirators for the protection of sanitary details from odors on the battlefields. A study of the available literature on fatigue was made. After considerable study of *Megarhinus splendens* mosquito, it was recommended that it be introduced in an effort to control *Aedes* mosquito breeding. Schools in rat control were held for officers of the 77th Division and schools in malarial control for units of the XXIV Corps. Arrangements were made with the Board of Health, T.H., to carry out a tuberculosis survey among USED employees.

During the month of May the presence of suspected cases of filariasis at APO 242 caused concern and a team was organized to study this problem and sent to APO 242. Continued emphasis was laid on training units stationed here in malaria control. There had been only minor outbreaks of diarrheal diseases in troops stationed here, but as a precautionary measure arrangements were made for the study and treatment of intestinal diseases in Prisoners of War at APO 958.

In June and July 1944, tests were made of the use of powdered borax in pit latrines to control fly breeding. A large shipment of Paradichlorobenzene was received and experiments could again be undertaken with this material. A study of available literature on diseases and sanitary problems of the Far East, particularly of the



Philippines, China, Formosa, and Japan was made. An analysis of Army and civilian cases of endemic typhus fever was made. Conferences were held with the Navy regarding special Aedes mosquito control measures in the vicinity of Hickam Field. Dengue fever had recently appeared in this area. Quarantine inspection of incoming task force troops was delegated to the Army port and Service Command. Circulars on the purification of water at advanced bases were prepared for publication. A special course in sanitation and tropical medicine was given to the medical department officers of the 81st Division.





### Section 3

#### Preventive Medicine in Central Pacific Base Command

(1 July 1944 to 2 September 1945)

The changes in command which took place 1 July 1944 placed the Medical Inspector's Office under Central Pacific Base Command. It was not until 1 August 1944, however, that the Statistical Health Reports (old WD, MD Form No. 86ab) went forward through AFMIDPAC. No important changes in the duties, functions, and organization of this office occurred. The office continued to be oriented towards offensive operations and conferences were held with Brig. General Maxwell of SPBC regarding filariasis and other special diseases. Conferences were held with various officers concerning sanitation of advance bases. Lectures on the use of sodium arsenite in battlefield sanitation were given to a Graves Registration Unit and three Quartermaster Service Companies.

In August, rat control work at airfields was completed and the 717th Sanitary Company transferred its control activities to posts and hospitals. More large scale experiments with paradichlorobenzene for fly control were conducted at the 13th Replacement Depot and areas JJ and HH of Schofield Barracks. Similar studies with DDT were undertaken at Aiea Staging Area. Studies with 5% DDT in kerosene for bedbug control were carried out. The results of the last mentioned experiment were excellent.

In September after many conferences with local authorities, the houses of prostitution in Honolulu were closed. Similar establishments elsewhere in the Territory of Hawaii had been closed previously. There resulted a slight decrease in the already low venereal disease rate among Army personnel and a striking decrease in the number of prophylaxes given in Honolulu.

A representative of the Medical Inspector's Office who had been on temporary duty with APO 244 returned. He had observed drilling and testing of wells, inspected wells and garbage disposal dumps, fills etc., and was consulted on numerous civil affairs problems, and proposed sites for hospitals and sanitary facilities on Saipan.

Fifty additional lantern slides were completed by the 5th Museum Arts Survey Unit to be used in conducting lectures on tropical diseases and their prevention. At their request SPBC

was supplied with information concerning CPBC procedures in delousing PW's. At this time the 6th Air Service Command Surgeon was notified informally that spraying of inter-island aircraft was suspended.

The month of October 1944, saw considerable activity of a routine nature, such as inspections, preparation of publications, training, continued liaison with Navy and Territorial Health officers, and investigations of minor outbreaks of communicable diseases.

In November 1944, a Sanitary Engineering Section separate from the Medical Inspector's Section was established. Observations on precautions to be taken with patients evacuated from forward areas were systematized and published as an annex to Medical Service, CPBC, Administrative Order No. 1.<sup>36</sup>

The year 1944 closed with the completion of the important test series No. 1 comparing PDB and DDT for fly control in latrine pits and the forwarding of the report of this work to The Surgeon General.

During January 1945, there was considerable interest in nutrition. The allowance of perishable cold storage foodstuffs for troops in the Pacific Area was to be reduced to approximately 1 cubic foot refrigerated cargo space per man per month. The chief dietitian of one of the general hospitals on Oahu was appointed by the Surgeon to assist the Quartermaster subsistence officer in writing a new menu for the CPBC ration, based upon the B ration plus one cubic foot of perishables. Several conferences were held to discuss the possibility of instituting large scale fishing to provide fish to supplement the CPBC ration. Representatives of Hawaiian Tuna Packers Ltd. attended these conferences. These people stated that they could catch a species of tuna in large tonnage if Naval restrictions were removed which prevented their boats from entering the best fishing waters. Some progress was made in having fishing restrictions lifted by the Navy, however, this type of tuna was a bloody fish, best suited for canning. No practical solution was reached which would bring fresh fish to the troop messes. Recreational fishing was increased, and what was caught was eaten. A program of mess inspections by teams was set up under the Quartermaster with a view to improving the quality of the preparation of food as much as possible.

Lectures in tropical medicine and diseases of the Hawaiian Islands were given to the medical officers of a small station hospital which arrived from the mainland. A school in rat control was given to personnel of a sanitary company. The Industrial Hygiene Officer was active, particularly in connection with study of the chemical



impregnation plants utilizing tetrachlorethane. Comparative tests of DDT and PDB as fly control agents in large pit latrines were continued. Administrative orders concerning first aid for fractures and quarantine were drafted.

During early 1945, a number of cases of severe urticarial dermatitis, some with constitutional symptoms, developed among swimmers at Ft. DeRussy. After considerable study it was proven that these lesions were caused by a previously not described marine hydroid which was found attached to the swimming rafts in large numbers. Periodic cleaning of the rafts was effective in preventing cases.

During February 1945, a paper was prepared upon the effect of the closing of the houses of prostitution upon the Army.<sup>37</sup> This paper was read before a public audience for Social Hygiene day. Venereal disease rates had been reduced to such low levels during the period when prostitution flourished on Oahu, that no spectacular further reduction was possible. There was no rise in rates, and there had apparently been no fall in the morale of the service men as a result of the closing of the houses.

Other routine work during January and February 1945, included investigation of two small outbreaks of bacillary dysentery among troops training on Oahu, drafting of an administrative order concerning laboratory services, inspections of prophylactic stations, and inspections of beaches for evidence of contamination by garbage dumped at sea. A Joint Army-Navy Disciplinary Control Board was formed. Two thousand two-ounce cans of louse powder were given to the Territorial Board of Health for use to protect rat control personnel in plague areas. Special studies were made concerning the health and housing of civilian employees of the Army. The availability of medical care for these civilians through civilian facilities was again checked and found to be adequate.

During March 1945, the Joint Army-Navy Control Board<sup>38</sup> began the first of a series of inspections of civilian restaurants. Several insanitary establishments were placed off limits for troops during the subsequent months. Conferences were held on the correlation of laboratory and clinical studies in cases of tetrachlorethane poisoning. A number of personnel from the chemical impregnation plants began to show laboratory evidence of poisoning and were relieved from this duty. Three new sanitary companies were trained in rat control. An administrative order summarizing all quarantine procedures was published.

During April 1945, considerable time was given to assisting the Information and Education Office in preparing a medical issue of the publication "Fighting Facts". A number of inspections were made of the Honolulu piers. Garbage disposal had been inadequate on these piers, and better arrangements were made. A representative of the Medical Inspector accompanied an officer of the U. S. Public Health Service in inspections of procedures in disinsectization of aircraft. Deficiencies were noted in procedures carried out by both the Air Force and the Army Transport Command. A complete report was submitted through channels.

Comparative tests of PDB and DDT in pit latrines were completed. Under the conditions of the experiments the PDB gave the more satisfactory fly control. The DDT in spray or powder form was not active against fly maggots in the latrine pit, although it was irregularly effective in preventing the new emerged adult flies from flying out of the pit.

The Industrial Hygiene Officer's accomplishments during this period included the design and supervision over installation of a ventilating system for an enclosed test firing range and inspection of several Quartermaster, Engineer and Ordnance Shops.

Routine sanitary inspections of all elements of the command carried on during the intervals between special problems. In general, at least one company per battalion was thoroughly inspected. Organizations were inspected by major echelons on several days notice. Sanitary conditions were generally excellent during 1945. The major sanitary problems, when they occurred, were in connection with the post exchange restaurants utilizing civilian help, or service men on detached service. These restaurants were frequently overcrowded.

During the last weeks of April 1945, an outbreak of diarrhea occurred in an infantry company attending a mortar school. The kitchen was inspected and found to be excellent, no faults in food preparation were found, and the outbreak of approximately fifty cases of mild diarrhea of several days duration remained unexplained. Stool cultures taken of the entire company by a competent bacteriologist were negative. The clinical picture had been consistent with an outbreak of mild Flexner dysentery. About two weeks previous to the outbreak about fifteen (15) men of the company had returned from Leyte where they had been observers.

The other dysentery outbreaks occurred about this same time in closely related field artillery battalions. One suffered a mild outbreak of Flexner dysentery during a period of amphibious training.



The unit returned to bivouac where a large number of Flexner dysentery carriers were diagnosed by rectal swab cultures, among troops who had eaten at one kitchen. All personnel exposed to this kitchen were given one tablet of sulfadiazine (1.0gm) daily for five days, after which all but two of forty (40) carriers had negative stools. These responded to a second course of sulfadiazine. Approximately one week later an explosive outbreak of diarrhea developed in a unit bivouac nearby. Stools were negative for all cases. The clinical picture in this outbreak resembled more a mild infectious dysentery than a food poisoning.

During the latter part of April, a number of mail sacks were delivered to the CPBC Base Post Office which were severely infested with insects. Positive identification of the insects was not made, but steps were taken to provide sprays and insecticides to Post Office workers. Later, at the suggestion of the Chief Quarantine Officer, U. S. Public Health Service, arrangements were made for the application of DDT residual spray to the walls and furnishings of post offices and baggage rooms at four month intervals.

During May 1945, there were a great number and variety of preventive medicine activities. An Aedes mosquito problem in a coral pot-hole area on the Ewa plain was attacked by spraying atomized DDT insecticide from a DeVilbiss spray apparatus. The insecticide, it was hoped, would be carried into areas of dense vegetation on the wind. Control of adult mosquitoes was fairly satisfactory for a period of two days. Aerosol generators have not been tried in this area. The DeVilbiss spray method was not repeated, as it appeared more practical to clear the vegetation, locate the breeding holes, and treat them accurately with DDT spray. A similar decision was reached in connection with a mosquito problem about the Kahuku Air Base where the Air Corps strongly desired to spray DDT from the air to eliminate a severe Culex infestation. A careful survey of the Kahuku Base showed the major Culex breeding to be in flooded basements and fire barrels and not in the adjacent waste areas. Airplane spraying would have been ineffective and wasteful, and local treatment was effective so long as Base personnel were sufficiently energetic to apply it. Conferences with entomologists for local agricultural industries were also held concerning their feelings in connection with the airplane spraying of DDT on the island. Every civilian authority consulted was firmly convinced that promiscuous airplane spraying over the Hawaiian Islands would upset biological balances of insect control which had been established through long effort and would be catastrophic to Hawaiian sugar and pineapple

industries. A general policy has been adopted to disapprove DDT airplane spraying in this area.<sup>38</sup>

An infantry division on Oahu reported satisfactory fly control in large pit latrines utilizing approximately one quart of 5% DDT in kerosene finely atomized into the latrine pit twice a week. Maggot activity could always be observed, but the appearance of adult flies in the latrine house was controlled. This same organization reported unsatisfactory results with PDB in latrines which were periodically filled with rain water or infested with the soldier fly, *Hermetia illucens*.

The Army provided quantities of dimethylphthalate to the Territorial Board of Health during May, for the impregnation of clothing used by plague control workers. A rodent control school was carried on for a newly activated sanitary company. The epidemiologist of a projected Army task force was given several weeks training at the Medical Inspector's Office. A comprehensive report on rodent control activities in the Hawaiian Area was written for transmission to The Surgeon General. A number of Army dispensaries and battalion aid stations were inspected for quality of the Medical Service. Steps were taken to obtain new figures on the CPBC Quartermaster ration with a view to undertaking an accurate analysis of the ration for nutritional adequacy.

One of the major industrial hygiene problems of the year occurred in connection with an Engineer asphalt plant which had been improperly located to the windward of a permanent Ordnance Ammunition Area. Smoke and dust from the asphalt plant became a serious nuisance to Ordnance personnel. Careful studies showed no silicosis hazard to Ordnance personnel, but steps were taken to secure the necessary smoke precipitators to lessen the hazard. A possible silicosis hazard was found in the aggregate tunnel of the asphalt plant, and steps were taken to secure adequate ventilation for this tunnel.

The final three months of the war found preventive medicine activities, aside from the ever recurring inspections, consultations, and control measures, concerned chiefly with a mild influenza epidemic, disease among the Okinawa POWs, and mosquito and insect control of mail sacks, baggage, and salvaged tires.

Early in July arrangements were completed with the 18th Medical General Laboratory and Malaria Survey Detachments to survey POWs for intestinal and blood diseases. Later in the month conferences were held at the MidPac Surgeon's Office with



particular reference to filariasis and it was decided to screen all Okinawans for filariasis and any who showed micro-filaria in the blood were to be returned to Okinawa. By mid-August a directive had been issued to the effect that POWs would not work in troop or officer messes; that POWs from forward Pacific areas would work only within their compounds unless specified precautions towards preventing the spread of intestinal diseases were taken; that POWs should be presumed to be infected until proved otherwise; and that POWs to be transferred to the mainland would only be surveyed and screened for filariasis, treated for vermin infestation and the critically ill transferred to medical facilities.

The problem of mosquito control in salvaged tires was investigated and an administrative order was prepared on this subject and published in mid-July.<sup>40</sup> Similarly the problem of infested mail sacks and baggage coming from forward areas was investigated and procedures necessary for more adequate control were incorporated in an administrative order.<sup>41</sup>

Because of the inflammable properties of DDT Emulsion Concentrate, the use of this material was prohibited except on approval of CPBC Headquarters. In early June several suspected cases of Dengue occurred in the civilian population and an immediate action letter to unit commanders directing that precautions be taken to prevent an epidemic was drafted. In this month's report was prepared at the request of The Surgeon General regarding medical care and control of civilians in CPBC. In August the whole problem of preemployment examinations of civilians was gone into and new standards and regulations were recommended. The problem of chlorinated hydrocarbons as used for degreasing came up again in connection with the 963rd Ordnance Company, and corrective measures instituted. Fly, mosquito and odor nuisances in a civilian area adjacent to John Rodgers Airport were investigated and the cooperation of the Board of Health, T.H., secured in having existing conditions corrected. Working conditions in the aggregate tunnel at Red Hill Hot Plant were found most unsatisfactory and recommendations were made for their improvement.

A representative of the Medical Inspector's Office completed an inspection of military installations at APO 240 and APO 241.<sup>42</sup> The Joint Army-Navy Board set up and enforced proper hygienic standards in local tattoo parlors. The Board continued its sanitary inspections of local restaurants, bakeries, etc.

A comprehensive investigation of the high non-effective rate in the 296th Infantry (a Puerto Rican unit) was undertaken in July 1945. This rate was out of all proportion to that of other Puerto Rican units. The chief causes for this non-effectiveness were infestation with intestinal parasites and psychoneurosis. It was determined that gross inefficiency on the part of responsible officers during staging of this unit in the Canal Zone was responsible for the accumulation in one organization and the forwarding overseas of such a large group of the physically and mentally ill.<sup>43</sup>

As the war ended preventive medicine activities were concerned chiefly with maintaining standards of insect and rodent control and in sanitary hygiene among the Army units stationed in CPBC.



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32. Ltr, Hq, CPA, 6 Oct 1943, File No. 720.3 Immunization, 1943, CPA, Off of Surg.
33. Filariasis Files, File No. 710 Filariasis 1943, HHD and CPA, Off of Dept Surg.



34. Diary of Medical Inspector's Office, 1944.
35. See Chapter 28 on Control of Insects.
36. File No. 704.11 Patients Returning to the Mainland, Miscellaneous, 1944, CPBC, Off of the Surg.
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## CHAPTER 22

### Clothing

#### (History of Preventive Medicine)

No special clothing requirements have existed in the Central Pacific Area. The climate is moderately warm with little variation. Headquarters CPBC, Administrative Order No. 1 (Index CPYQM 114.20), Basic Authorized Allowances of Outer Clothing for Enlisted Men in Central Pacific Base Command, dated 12 April 1945,<sup>1</sup> is representative of clothing requirements in the area.

Requests have been received from time to time from forward bases on Pacific Atolls for shorts and short sleeved shirts, CKC. These items were at one time authorized for issue, but further procurement was rescinded in letter, file AG 421.1 (18 August 1943) OB-S-SPODG, subject: Short Trousers, dated 6 September 1943.<sup>2</sup> Request for reconsideration in this matter was not favorably considered by the War Department in March, 1944.<sup>3</sup> Nevertheless, continued requests for such items of clothing have been received.<sup>4</sup>

Short trousers and short sleeved shirts have been contra-indicated for bases where malaria, dengue, filariasis, encephalitis, scrub typhus, and other insect or arthropod-borne diseases exist. However, there have been no such disease conditions to contra-indicate the wearing of such clothing on the coral atolls of the Line, Phoenix, and Marshall Islands. Dengue fever, the only problem in the Gilbert Islands, was infrequent after April, 1944. The issue of such short clothing could have been of value in the Line, Phoenix, Gilbert, and Marshall Islands from the standpoint of comfort. Such clothing could have been of light color, light weight, and loosely woven, inasmuch as it would not be required to give protection against insect bites. The khaki and herringbone twill cloths have been criticized because they are too tightly woven, and because the latter is too dark in color. If short clothing had been authorized for Central Pacific bases where insect and other arthropod-borne diseases did not exist, precautions could have been taken to prevent the dissemination of such clothing to bases where not authorized.

Training of all elements of the Central Pacific Base Command, except for personnel designated by order for employment in the Hawaiian area only, were given training in the use of wet-cold clothing and equipment during June 1945. Letter Headquarters Army Ground Forces, File 710/111 (20 January 1945) CNGBI, subject: Prevention of Trench Foot and Frost Bite, dated 20 January 1945, was used as a basis for this training.

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3. Radiogram, War Dept to Commanding General, CPA, File No. 420, Clothing and Equipage, Serial No. 3, Office of the Surgeon, CPA, 1944.
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## CHAPTER 23

### Housing

#### (History of Preventive Medicine)

The climate in the Central Pacific is pleasantly warm to cool depending upon elevation above the sea. No insulation of walls or ceilings against heat or cold has been necessary. Glass windows have been unnecessary for temporary troop barracks. In some localities provision has been made for shutters on the windward side. During the years 1941 - 1943, a certain proportion of troop buildings were provided with black-out shutters to allow for work and recreation in the evenings. These black-out shutters consisted of black painted hoods over ventilation apertures, which allowed some passage of air but prevented lights in the interior of the building being seen from the air outside. Wire screening has been desirable, because of the common night-flying mosquitoes. Rainfall varies from scant to heavy, depending on elevation and situation as to prevailing winds and mountain masses. Watertight roofs with overhanging eaves or adjustable side walls for tents have been essential. Dust problems have existed in instances as a result of the excessive destruction of ground vegetation in bivouac areas, or if buildings are placed too close to dirt roads. Heavy rains during certain seasons in some localities have resulted in excessively muddy ground conditions. Under these circumstances bivouacs have been provided with coral, gravel, or asphalt roads and paths or board walks. Otherwise building floors have become heavily soiled with mud. It has been required that all buildings and tent floors be raised off the ground, preferably 18 inches, to prevent rat infestation, and that trees be cut back at least three feet from building roofs to prevent climbing rats from gaining entrance. For protection from insects and rodents all openings except doors have been securely covered or screened, and doors provided with automatic closing devices. The floor area per man required in sleeping quarters has been minimal. The mild climate allows for excellent ventilation. Upper respiratory infections have been mild and their incidence relatively low (75 - 125 admissions per thousand per annum). Pneumococcus pneumonia, meningococcus meningitis, and scarlet fever have been uncommon diseases in the Central Pacific, and when they have occurred they have usually been found among personnel recently arrived from other areas. Measles, mumps, and chickenpox have not been a problem. Housing in the Central Pacific Area has been based upon a minimum standard of 40 sq. ft.

per man, and experience has shown this standard to have been adequate. When beds have been placed closer than 5 ft. apart, head to foot sleeping has been required.<sup>1</sup>

When troops took up field positions on 7 December 1941, housing was almost entirely improvised. For reasons of camouflage very few tents were used. Small camouflaged one and two man shanties made from box wood or waste lumber, small excavations in the ground, bomb shelter or vacant civilian habitations were commonly used for shelter.

During the middle period of 1942, the Hawaiian Department Engineer designed and began the mass production of a housing unit known as the 16' x 20', portable prefabricated barracks. This unit was provided with heavy tar paper roofing and with solid wood lower and wire screen upper side walls. Including the wood floor it was prefabricated into 16 pieces, four floor, four end, four side wall, and four roof sections. At first these portable buildings were issued only to troops in field positions on the basis of one per sixteen men, to be used with double-decker canvas bunks.<sup>2</sup> As production caught up with the demand, the basis was lowered to one building per eight men. These buildings were also used singly or connected in series for kitchens, mess halls, offices, dayrooms, post exchanges, classrooms, shower rooms, supply rooms, and aid stations. A prefabricated screened latrine building in six sections was developed for use over pit latrines. The use of tentage was largely confined to posts, regimental combat team bivouacs, and training camps.

Regimental and battalion combat team camps were constructed in the Hawaiian Islands in 1943 for divisions training and staging in the area. These camps consisted of company size units of pyramidal tents on tent floors; enclosed, but unroofed showers, dressing rooms and washstands; screened-in kitchens, 16' x 20' in floor area; outside ice cooled refrigerators; waist-high tables without stools under tent flies for mess halls; and large, deep eight and twelve hole pit latrines in screened latrine houses. Each camp was provided with buildings for headquarters, a post exchange, a classroom, and a dispensary. In addition, open air theaters and playing fields were constructed.

Existing posts have been expanded during the war by the use of cantonment type buildings. Water and electric services, oil burning kitchen ranges, electric refrigerators, and hot water for washing and showers have been provided.

Kitchens have been screened throughout the Command, and the majority of units have been provided with screened mess halls.



Hot water for bathing was dependent upon the initiative of troops in improvising facilities until 1944, when the Engineers were able to provide most units with hot water heaters. Day-rooms, post exchanges, and beer gardens are provided to almost all units. The unroofed shower room has been very satisfactory, hygienic, and easy to keep clean of mold growths on floors and walls. Kitchen and shower waste water has been disposed of into covered soakage pits of natural stream beds, usually after passage through some type of baffle grease trap. Waste water run into natural drainage channels has been a prolific source of pest mosquitoes where mosquito control measures have not been taken. Concrete slabs with rims and drains leading to kitchen grease traps have been constructed by some organizations for washing of kitchen utensils and garbage cans, for garbage can stands, and for platforms for mess kit laundries. These concrete platforms have been very satisfactory in preventing pollution of the ground with food particles incident to the washing processes, and have eliminated fly breeding in the soil so polluted. Water-borne latrines have been provided for field positions within congested civilian areas, and for the majority of units situated upon permanent Army posts. The following directives have been published concerning housing and utilities:

1. Circular No. 64, Hq Hawaiian Department, subject:  
Accountabilities and Issue of Portable Buildings,  
dated 4 August 1942.<sup>2</sup>
2. Circular No. 62, Hq, Hawaiian Department, subject:  
Housing and Utilities, dated 12 May 1943.<sup>3</sup>
3. Administrative Order No. 1 (Index CPENG 700.50),  
Housing and Facilities at Posts, Camps and Field  
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## CHAPTER 24

### Nutrition

#### (History of Preventive Medicine)

1. Character of rations. Prior to the attack on the Island of Oahu on December 7, 1941, the ration allowance for the Hawaiian Department was considered ample. The food supply was abundant and with a few minor exceptions messes were well conducted and menus well selected under the garrison ration system. Following the attack on the island, however, ocean shipping ceased immediately. The Army was automatically placed on a field ration basis with the issue starting 9 December 1941 after the garrison rations on hand had been used up. On the field basis, menus were arranged and food issues were determined by the Quartermaster Department.

With the reestablishment of ocean shipping under the convoy system there was no food shortage in the Hawaiian area. From 1942 through 1945 field ration "B", supplemented by some refrigerated supplies, was used in the Hawaiian Islands. Overall food allowances were ample in general. There was some scarcity of fresh fruits and vegetables throughout the war, but these items were issued whenever availability permitted. No fresh milk was used by military messes except in the treatment of hospital patients. One reason was for security against biological warfare; another, because of an inadequate local supply. Both dried and evaporated milk were employed.<sup>1,2</sup>

Rations C, D, and K were utilized by task forces in the early stages of campaigns but were supplanted by the "B" ration as soon as practicable. The nutritional values intended to be obtained from these special rations were diminished in actual practice by distaste for some components. In the operations on Kwajalein in early 1944, it was observed that the biscuits, malt and dextrose tablets, synthetic lemon powder and cheese in the K ration were rarely consumed in full amounts. Of the C ration, the biscuits, meat and vegetable hash, and synthetic lemon powder were usually discarded to a considerable extent.<sup>3</sup> The assault ration appeared to be accepted satisfactorily.

To supplement the "B" ration, reefers were used extensively at remote island bases, thus making the issue of some fresh frozen articles possible. A study was made of the

possibility of supplementing the dietary at distant island stations with locally caught fish of which there was an abundance. The use of this type of food, however, presented technical difficulties, the securing of boats, the danger of poisonous fish, and the need for prompt refrigeration. On Christmas Island a task force livestock farm under the supervision of a veterinary officer produced fresh milk, eggs, and pork for hospital patients, and some surplus was issued to troops.

2. Nutritional evaluation of rations. In May 1942 an estimate was made by the Hawaiian Department Medical Inspector's Office of the vitamins supplied by the issued field ration. All vitamin values exceeded the minimum daily requirements of the American Medical Association Committee on Foods. It was realized, however, that the rations actually accepted and consumed provided lesser quantities of vitamins than this issued ration. No deductions were made for waste or losses in cooking.<sup>4</sup> Another estimate was made in March 1942 of the nutrient content of the ration for the 24th Infantry Division and the other North Sector, Oahu, troops by the division medical inspector. All nutrients were found to exceed National Research Council standards, although deductions were not made for cooking and preparation losses, and the estimated consumption was based on the opinion of a mess officer and a mess sergeant rather than actual observed amounts.<sup>5</sup>

A nutritional analysis of the Hawaiian Department field ration menu in 1943 indicated that the ration offered to the troops was high in calories (5114) as compared with National Research Council recommended allowances (3000 to 4500, the latter for the very active troops).<sup>6</sup> Specific nutrients, with the exception of riboflavin, would have been adequate if the entire planned ration were consumed. It was noted, however, that this was not the dietary as actually consumed; no deductions were made for the refusal by organizations of items offered in the ration, nor for waste or losses in preparation and cooking.<sup>7</sup> A considerable proportion of the ration was not used, indicating that the organizations to a marked extent selected themselves the quantities and items of the consumed dietary.<sup>8</sup> Among the factors cited as involved in lack of acceptance were overly large total issues, the inclusion of some unpopular foods, and poor preparation of food in some messes.<sup>9</sup>

In April 1943 the question of the calcium content of the Hawaiian Department field ration came under study by the Department Medical Inspector's Office. From an estimate of the overall amount of food consumed from this ration, prorated to its calcium content, it was felt that the average calcium intake was of doubtful adequacy. However, it was recommended that the proposed addition of



calcium salts to the flour be considered only if measures to increase the issue and consumption of other foods -- notably evaporated milk and cheese -- proved to be unsuccessful. The amounts of the latter offered in this ration were declared to be considerably less than directed in AR 30-2210, and a revision was recommended.<sup>10</sup>

An analysis of the intended issue for April 1945 at APO 957 on Oahu and APO 960 on Hawaii was made by the CPBC Medical Inspector's Office. Even with an estimated 10% deduction for waste, the caloric values of the ration offered to the messes was high: 4500 and 4710, respectively, as compared to a probable need of 3500 calories or less. Vitamins B<sub>1</sub> and B<sub>2</sub> barely met the allowances recommended by The Surgeon General's Office.<sup>11 12</sup>

To obtain information on the values of the ration as actually consumed, data were obtained from the depot at APO 957 for the month of June 1945 as to the amounts of each item actually accepted by organizations out of the intended issue. Analysis of these quantities indicated that in the process of self-selection by the messes from this issue the accepted dietary furnished less than the recommended allowances of B<sub>1</sub>, vitamin B<sub>2</sub> and calcium, with calories at a level of 3550. There was a failure of acceptance of the full offered amounts of evaporated milk, flour and vegetables. It was anticipated, however, that the new menu then being prepared would improve the nutritional situation, along with the active educational program for mess personnel under the food service program.<sup>13</sup>

In a nutritional survey conducted by a War Department team in April 1945, the estimated nutrient intake of troops on Hawaii was found adequate by National Research Council standards except for slightly low riboflavin and calcium values.<sup>14</sup>

3. Vitamin concentrates. In March 1942 a request was made to The Adjutant General, Washington, D. C., for sufficient multivitamin products to provide 100 daily prophylactic doses for each person subsisting on the Hawaiian Department field ration. The possibility was cited that enemy action might reduce the amounts of vitamin supplying foods in the ration, with adverse effects on the health and efficiency of the command. Supply of this amount was granted, with the recommendation by The Surgeon General's Office that the adequacy of the ration and probable shortages be determined before issuing or requesting further supplies.<sup>15</sup> To acquaint units of the command with the necessity for determining the adequacy of the ration before requesting vitamin supplements, a Hawaiian Department memorandum to that effect was circulated in 1942.<sup>16</sup> Request was made of civilian drug wholesalers that they

maintain larger stocks of vitamin concentrates, to be available if needed.<sup>17</sup> In addition to concentrates used in forward areas throughout the war for supplementing the Army ration, the number of vitamin capsules held in reserve was maintained at 5% of the total number of reserve rations.<sup>18</sup> The taking of vitamin capsules was left to individual choice in outlying bases until a Hawaiian Department directive in April 1943 instructed that the daily ingestion of at least one capsule daily per man be insured. On Oahu, personnel in underground stations and in certain air corps units also received this prophylactic dose, as did those in headquarters units.<sup>19 20 21</sup> Troops in the immediate Hawaiian area on the standard ration did not receive vitamin supplements.<sup>22</sup>

After seven weeks of the mandatory use of vitamin capsules by all personnel, it was reported by the First Station Hospital on Makin Island that medical officers and unit commanders had observed beneficial effects, including a 40% decrease in attendance at "sick call", a lessening of susceptibility to infections, and a decrease in healing time of minor cuts and injuries. Although the dietary had been improved in that time, it was recommended that administration of supplemental vitamins be continued.<sup>23</sup>

4. Revisions of the ration. In January 1945, a revision of the field ration menu, USAFICPA, dated 1 February 1943, was worked out by the CPBC Quartermaster and Surgeon's Office. It was designed to conform with new basic ration issues necessitated by a reduction of cold storage items to one cubic foot of shipping space per man per month in the Hawaiian area.<sup>24</sup> (Simultaneously the refrigerated supply to forward Pacific Ocean areas was raised to 1.4 cubic feet per man-month, and ranged up to 2 cubic feet, depending on supply, throughout 1945).<sup>25</sup> In the new menu efforts were made to improve acceptability by attention to color and consistency of the meals, varied recipes for the less popular items, and adaptability to field ranges and mess kits.<sup>26</sup> In March 1945 this menu was submitted to the San Francisco Port of Embarkation for approval.<sup>27</sup>

In May 1945 a response was obtained from the War Department in which it was stated that the quantities of different food groups in the proposed menu were excessive, and limits were set on the maximum poundage of each food group to be allowed.<sup>28</sup> Another menu was accordingly prepared. The quantities of various items were based not only upon the limits specified but also upon the amounts currently accepted by the messes from the local issuing depots.<sup>29</sup> Ice cream powder was included in this menu as part of an effort to increase the calcium and riboflavin intake.<sup>30</sup>



5. Food Service Program. A Food Service Program was established in CPBC in February 1945 under the Quartermaster, CPBC, as Director. Its aims were such as to improve troop feeding from the nutritional standpoint, particularly as to mess inspection, the preparation of food, and the training of mess personnel.<sup>31</sup> In accordance with its provisions a food service supervisor was designated for the Medical Service, CPBC.<sup>32</sup>

6. Civilian Feeding. In early 1942, because of the limited amount of refrigerated shipping space, the Surgeon was consulted as to the dietetic necessity of importing the relatively bulky oranges and lemons from the mainland. After investigation the opinion was rendered that these items could be curtailed without detriment to the health of the people in view of the availability of fresh pineapple and papaya. It was felt, however, that the importation of canned fruit juices should not be curtailed. The recommendation was made that reserved stocks of vitamin concentrates should be established.<sup>33</sup> Subsequently a request was made of civilian drug wholesalers that they maintain larger stocks of vitamin concentrates, to be available if needed.<sup>17</sup>

7. Specialized Nutrition Personnel. In the course of a study of food and nutrition problems in the Central Pacific area in May 1942, a veterinary officer recommended the establishment of a food and nutrition office, with the assignment of nutrition officers and other personnel to the CPA Surgeon's Office and to each sector, district and garrison force. This recommendation was not accepted, however, as it was believed in the Surgeon's Office that such a section would have no practical value.<sup>34</sup>

In January 1945, 1st Lt. L.S.M. Nelson, Medical Department Dietitian, 147th General Hospital, was appointed Consultant in Nutrition to the CPBC Surgeon's Office for the purpose of reviewing the ration issue for nutritional adequacy.<sup>35 36</sup>

Lt. Nelson was succeeded on 21 March 1945 by 1st Lt. Dorris Forbes, HD. 1st Lt. W. H. Halvorsen, HD, served in this capacity from 15 May 1945 to July 1945. From June 1945 the Nutrition Consultant, AFMIDPAC Surgeon's Office, 1st Lt. C.D. Buss, SnC, was used part time in the same capacity by the CPBC Surgeon's Office.<sup>29</sup>

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## CHAPTER 25

### Personal Hygiene

#### (History of Preventive Medicine)

Personal Hygiene in the Central Pacific Area was in general satisfactory. Troops quartered in the Hawaiian Islands had adequate water supplies so that bathing and laundry was no problem.

Troops stationed on the forward islands had a much more difficult time keeping clean. At first, only brackish water was available for showers and laundry. No laundry equipment was at hand, so many improvised washing machines were fabricated by the soldiers. These machines were in general of two types, (1) wind driven<sup>1</sup> and (2) engine driven<sup>2</sup>. The wind driven machines were used early in the occupation of forward islands. An almost constant trade wind blows in many of these areas, and full advantage was taken of this fact. In general, a propeller was mounted on an axle shaft and a connecting rod was used to drive an agitator. Later, drum washers were often used, powered either by a jeep or a truck, or sometimes with a small motor salvaged from a generator set.

The brackish water used in forward areas made the use of large amounts of soap necessary. This was countered in some measure by the availability in PX's of synthetic detergents. Salt water soap was also furnished to the men, and was a useful item.

Care of the feet presented its usual problems in this area. Early in 1942, the Orthopedic Consultant made several spot inspections in which serious deficiencies were found. A directive<sup>3</sup> concerning the proper care of the feet was issued by HHD on 16 March 1942, following which a marked decrease in incidence was noted.

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## CHAPTER 26

### Section I

#### Water Supply

##### (History of Preventive Medicine)

The history of the supply of a potable water to the United States Army in the Central Pacific Area, is closely related with the history of the Anti-Biological Warfare. Section II of this chapter covers in detail the measures taken to protect the water and food supplies from sabotage or biological warfare. These measures also covered normal laboratory and sanitary measures for the protection of the food and water supplies. The Medical Department, as regards to water, is charged primarily with the responsibility of determining the sanitary quality of water supplies to troops by the Corps of Engineer. The Engineer's responsibility is to furnish a sufficient quantity of potable and palatable water for the use of troops. The work of the two Departments is closely related and the cooperation between them has helped materially in providing troops with a safe water.

At the outbreak of hostilities with Japan in 1941, the water facilities in the Hawaiian Islands were inadequate to carry the load that must necessarily be put upon it. In addition to the troops in the Hawaiian Islands, the influx of thousands of war-workers made the problem of an adequate quantity of water more difficult.

The sources of water available to the Army on the Island of Oahu were four (4), namely, the City and Suburban Water Supply Companies; the already developed Army supplies; the supplies owned by the sugar plantations, and used by them for irrigation; and the undeveloped underground supplies.

The Board of Water Supply of the City and County of Honolulu is charged with the responsibility of supplying water to the City of Honolulu and contiguous areas. The tremendous growth of the City's population has made over a 100 percent increase in water requirements since 1939. The Board had developed a long range program for both the City of Honolulu and the Island of Oahu. It was realized that with the increased water requirements, and with definite indications of salt encroachments, preliminary steps toward proper ground water control would be necessary. In 1940, a

commission was appointed by the governor to study the ground water problem and control the withdrawal of ground water.<sup>1</sup>

The principal sources of City Water Supplies are the Kalihi Underground System; the Nuuanu System; the Beretania System; the Kaimuki System; and the Waialae System. All of these systems draw their water from underground sources and it is pumped to reservoirs located at strategic points on the system. In addition to the above systems, the North Halawa water development project was completed in 1944. The total water supplied by the various public and privately owned water systems in the City of Honolulu has increased in the following manner: 1940, 36.9 million gallons per day; 1941, 39.9 million gallons per day; 1942, 42.8 million gallons per day; 1943, 60.0 million gallons per day; 1944, 68.9 million gallons per day<sup>1</sup>.

The two (2) factors which the Medical Department was chiefly concerned with in the City Water Supply, were the purity of the water and the chloride content of the water. The amount of infiltration from the continued deficient rainfall has been insufficient to supply the increased water demands and, as a result, the reservoirs in the Honolulu artesian basin are being heavily over drawn. Due to the geological structure of the artesian and basalt basins, it is necessary to maintain a definite static head of fresh water over the underlying salt water upon which all of the fresh water in the island floats. With the low artesian head prevailing in the area, the draft-chloride content relationship was carefully watched and regulated by controlled pumping. An illustration of this is in the Waialae Underground System. It was determined that if the pump station was operated to capacity that the chloride content increased to a point which made the water unsuitable for domestic consumption. By pumping only 50 percent of the daily designed capacity, the chloride content remained within normal limits.

In accordance with Medical Department policy, it was required that all the water supplied by the City to Army installations be chlorinated. (The regulations and procedures governing the chlorination of water are discussed fully under the Anti-Biological Warfare Activities, a section of this chapter).

At the outbreak of hostilities, the Suburban Water Supply Company was supplying the Kaneohe and Waimanalo Bay Areas from the Haiku Tunnel. An additional supply, known as the Luluku-Springs was available but was not being used, due to the fact that the water was contaminated and constantly showed the presence of the coli-arogenes group of organisms. With the



continued drought in 1944, it became necessary to connect the Luluku-Springs into the system. In order to insure the safety of this water, the Suburban Water Supply Company chlorinated it at the source and the Army and Navy rechlorinated it at the service connections.

In accordance with Army Regulations, the Haiku Tunnel was chlorinated continuously. In 1945, an additional supply was added to the Haiku Tunnel line by pumping the seepage from the tunnel into the pipeline prior to chlorination. The normal yield of Haiku Tunnel was six (6) million gallons per day. The rainfall on the Haiku watershed has been approximately 60 percent of normal over the past two (2) years. The yield of the Tunnel, however, has dropped more than 50 percent, due to the fact that while the rainfall has been over 60 percent, there had been no heavy precipitations at any period. No appreciable effect is felt on the Tunnel with less than 50 inches of rainfall per month.

The Suburban Water Supply Company also supplies chlorinated water to a number of posts, camps, and stations on rural Oahu. These are all well supplies and the yield has not apparently diminished.

The sugar plantations on Oahu use millions of gallons of water daily for irrigation. An elaborate system of ditches carrying water for irrigation has been developed by them over a long period of time. The Army has been able to purchase water from the plantations for use in areas adjacent to the irrigation ditches. Practically all of the water taken from the irrigation ditches is chlorinated at the "point of take". A few small installations use plantation water and chlorinate the drinking water in Lyster bags. A number of slow sand-filter plants have been installed on the larger installations using irrigation water. The Waihole Ditch is the principle source of irrigation water and the Honolulu Plantation, the Ewa Plantation, and the Waiānae Plantation also supply some water for Army consumption.

At the beginning of the war, Schofield Barracks was supplied by its own water system, namely, a deep well system located off the main post. With the increase in population of the post, it was necessary to develop another source. A surface supply was developed and has been used to supplement the well supply. While this water is made safe for human consumption by chlorination, it is frequently turbid. Plans for a modern filter plant are being prepared at the present time.

Most of the water for the Post of Shafter is supplied by an Army deep well. Supplemental supply is provided by a connection with the Halawa System of the City Supply.

The Army has also developed a number of wells on some of the smaller posts, all of which are chlorinated before use, except the well for fire protection developed in Aliamanu Crater. The fire system in the Crater is entirely independent and no cross connections exist between the potable water system and the fire protection system.

The conditions existing at the outbreak of hostilities on the Islands of Kauai, Maui, Molokai and Hawaii were very similar to the conditions on Oahu. The existing water supplies were inadequate to meet the increased demands caused by the influx of military and civilian personnel. Where possible, the existing supplies were enlarged and made available to the Army camps. As on Oahu, the county and plantation water systems were used as sources of water. Where treatment was necessary the Army or Navy put in their own treatment plants.

None of the existing supplies were chlorinated until the military personnel moved in. Chlorinators were furnished the local water systems and installed for them. The chlorinators were operated by the plantations or county.

The Medical Department was charged with the responsibility of seeing that the proper chlorine residuals were maintained at all times. The Anti-Biological Warfare activities, in connection with water, were supervised jointly by the Medical Department and the Chemical Warfare Service.

In several areas, where the ground water supplies were deficient, water was collected from the roofs of buildings and stored in wooden storage tanks. This water was also chlorinated and made a very satisfactory supply to augment the ground water.

All of the outer islands have felt the effect of the low rainfall during the past three (3) or four (4) years. Obtaining sufficient water on several of these islands had become a very serious problem, prior to the cessation of hostilities.

The geology of the Coral Atolls is such that the water problem is practically the same on all of the atolls occupied by our troops in the Central Pacific Area. Typical of these are Canton, Christmas, and Fanning Islands. Drinking water on Canton and Christmas Islands is obtained by distillation of sea or



brackish well water. Drinking water on Fanning Island is obtained from shallow wells. All of these supplies must be chlorinated either at the source or in Lyster bags.

The Medical Department was called on to work out and issue directives on a number of special problems in which water supplies were involved. Some of these were special purification methods where amoebic dysentery<sup>2</sup> and Schistosomiasis<sup>3</sup> is prevalent and the use of marpharsen ampules<sup>4</sup> in the sterilization of distilled water.

The Sanitation Section of the 18th Medical General Laboratory developed a continuous flow method for treatment of water<sup>5</sup>. A field testing kit for the simple water determinations in the field and determinations of certain toxicological poisons was also developed and prepared by them.

Sanitary surveys<sup>6</sup> of water supply installations were made on all the principal water supplies on the Island of Oahu except, Schofield Barracks. These surveys covered the quantity of water used, source of water, treatment plants and methods, distribution systems, and Medical Department supervision. Recommendations were made covering defects found in the water supply system. Follow-up inspections were made to see that these recommendations were carried out. The Medical Department cooperated with the Engineering Department in solving difficult problems resulting from the recommendations.

From time to time the Medical Department was called upon to inspect the various swimming areas around the Hawaiian Islands. The proper inspection of these areas required a complete sanitary survey of contiguous areas and the collection for bacteriological examinations of a large number of water samples.

A number of swimming pools were built on the Island of Oahu and these were under the supervision of the Medical Department. Inspections and studies were made of these pools and recommendations were made as to improvements and standard procedures of operation.





## CHAPTER 26

### Section II

#### History of the United States Army Medical Department

#### Activities in Anti-Biological Warfare in the Hawaiian Department

#### (History of Preventive Medicine)

The History of the United States Army Medical Department in the development of protective measures against bacterial or chemical agents in the Hawaiian area is one of long consideration and practical application of scientific knowledge. The possibility that Bacterial or Biological Warfare might be used by an enemy had been discussed and precautionary measures were taken in the Hawaiian Department prior to the onset of hostilities on 7 December 1941. Sanitary inspections of military installations had been intensified. Local food processing plants were more frequently inspected. The major sources of water supplies were provided with fencing and in some instances were guarded.

The Commanding General, Hawaiian Department, assumed the duties of Military Governor of the Territory of Hawaii on 7 December 1941.<sup>7</sup> The Surgeon, Hawaiian Department became advisor to the Commanding General in all matters pertaining to the health of the population of the Territory as a whole as well as to the health of the military command. The problem of protection of the military and civilian population from this type of attack was carefully reconsidered and evaluated. Attention was focused on this subject by a false report on 7 December 1941 that the water supply, particularly that of Hickam Field, was "poisoned". Under the authority of the military government the following precautionary measures were instituted:

1. All military personnel and all civilians over six (6) months of age were immunized with smallpox, typhoid, paratyphoid A and paratyphoid B vaccines. 8, 9, 10, 11.
2. Poisons were impounded and their sale and distribution kept under strict control. 12, 13.

3. The principal water supply systems of each island were investigated in detail and the use of fencing and guards was increased.
4. The Department Laboratory performed daily tests for some of the more common poisons on water samples from principal water supplies.
5. The purchase of fresh milk for use in Army messes was prohibited. <sup>14 15</sup>

On the 19 June 1942, a local Honolulu Physician wrote a letter on the subject, "The next attack upon Oahu - Bullets - Bombs or Bacteria".<sup>16</sup> The Physician sent this letter to the Commanding General, Hawaiian Department and copies to the Secretary of War, Secretary of Navy, Chief of Naval Operations, and Commander in Chief of the Pacific Fleet. On 30 June 1942, the Chief of Staff, War Department, directed the Commanding General, Hawaiian Department to set up the necessary organization and take measures essential to control or counteract the activities which were the subject of the physician's letter.<sup>17</sup> Steps were immediately taken to obtain all available information and advice on the subject of Bacterial Warfare, and to establish a definite organization for studying, coordinating and implementing the required countermeasures. Technically trained personnel were requested from the War Department. A Lieutenant Colonel, Sanitary Corps, and a Captain, Medical Corps, arrived in the Hawaiian Department and were assigned to the Surgeon's Office, Hawaiian Department on 5 September 1942. On 8 October 1942, the Surgeon, Hawaiian Department, who had been acting as the Department Commander's advisor, was detailed Anti-Biological Warfare Officer in addition to his other duties.<sup>18</sup> Anti-Biological Warfare Officers were designated at the Headquarters of the Hawaii, Maui, and Kauai Districts.<sup>19</sup>

The period from December 1941 to April 1943 was a period of intense activity and accomplishment in the field of developing safeguards against Biological Warfare. On 14 April 1943, a very comprehensive report of the Anti-Biological Warfare program in the Hawaiian Department was submitted to The Adjutant General, War Department, Washington, D.C.<sup>20</sup> The developments and countermeasures in effect at that time were:

1. The use of fresh milk in Army messes was prohibited.<sup>8,9</sup>
2. All drinking water used by troops was being chlorinated.<sup>21</sup>



3. The Military Governor had ordered continuous chlorination of the principal water supplies <sup>22</sup> and the project was progressing favorably in spite of the magnitude of the difficulties encountered. The water systems were numerous, varied in type and complex. In many instances accurate knowledge of engineering data was not available and extensive liaison work with the city, county, plantation and Army Engineers was required. Qualified personnel skilled in the installation of chlorination equipment were difficult to obtain. The preparation of specifications, procurement of equipment even with an AAA priority and the shortage and shipping space all tended to make the chlorination project a laborious task. The burden of the work fell on the U. S. Army Engineers but considerable aid and advice in expediting the work was furnished by members of the Surgeon's staff. A system was instituted for checking the chlorine residual in each distribution system at two hour intervals from 0700 to 1900 and once during the night at approximately 0200. This testing not only served to insure that the chlorination equipment was operating properly but was also of value as a signal in the event of intentional contamination since the contaminating material would cause the disappearance of the residual chlorine.
4. A method of biologically checking for the presence of chemical poisons in the water supply was devised and installed on the principal water systems. <sup>20</sup> This method utilized the "Guppy" (*Lebistes reticulatus*) and the "Mosquito Fish" (*Gambusia affinis*) as indicators in a small aquarium through which water flowed continuously.
5. The Department Laboratory and laboratories at Army hospitals made daily analyses on water samples from the main water systems for chemical poisons.
6. After a thorough investigation of the type and quantity of the food locally supplied to the Army, specific control measures were placed in effect. Ice cream, bottled soft drinks and candy manufacturing plants were found to be particularly amenable to biological sabotage. <sup>20</sup> The Counter-Intelligence

Division of G-2 investigated the civilians employed in these plants. Military personnel were assigned to key positions in the plants where they could be actively engaged in the process of mixing the ingredients and thus prevent deliberate large scale contamination. These men were specially selected from the command as a whole for proficiency and past experience in the type industry to which they were assigned. The men were transferred to Medical Department Units and placed on Detached Service. The Veterinary Corps exercised administrative and technical supervision over these Anti-Biological Warfare enlisted inspectors. After many months, on 11 September 1944, a T/O organization, the 113th Medical Service Co (Vet) was authorized and activated.<sup>23</sup> With the activation of this unit it was possible to have all the Anti-Biological Warfare enlisted inspectors assigned to one organization for administration and duty. In addition to prevention of intentional contamination of the food the inspectors maintained high standards of sanitation in the plants through persistent efforts to impress upon the management and employees the importance of good sanitation. The inspectors maintained a close laboratory check on the finished product by frequent submission of samples to the laboratory for study.

7. The Military Governor required all civilian laboratories to register.<sup>24</sup> All bacteriological laboratories were inspected and personnel of Japanese ancestry who had had training in bacteriology were investigated by the Counter-Intelligence Division of G-2.
8. The civilian and military rat and mosquito control measures were intensified.

The execution of many of the above activities required the authority of the Military Governor. In February 1943, provision was made for the return to the proper civilian authorities of a portion of the functions performed by the military Governor. Agreement as to the continuance of the Anti-Biological Warfare controls and such other measures vital to the health of the population was reached by a mutual exchange of letters between the Civil Governor of the Territory of Hawaii and the Commanding General, Hawaiian Department.<sup>25 26 27</sup> The General Orders Nos. 1 to 181 inclusive, were rescinded on 10 March 1943.<sup>28</sup> The necessary regulations covering the registration of laboratories and the control of poisons were incorporated in the Hawaii Defense Act Rules.<sup>29 30</sup> The Office of



Civilian Defense assumed the administration of the control of laboratories and poisons. Information was available to the Surgeon at all times.

The Anti-Biological Warfare efforts during the remainder of 1943 were devoted to the extension of the basic control measures already outlined. Close liaison was maintained through personal contact with the staff of the Medical Officer, 14th Naval District and with the civilian agencies concerned with various aspects of the work. In October 1943, at the insistence of the War Department, all military personnel were immunized with yellow fever vaccine.<sup>31</sup> Constant study and re-evaluation of the protective measures in effect was required with changes in disposition of troops. This factor was particularly apparent on the islands of Hawaii, Maui, and Kauai, where frequent changes in unit dispositions took place. The demand for ice cream and soft drinks increased during 1943 and 1944 with the ever-mounting number of service personnel in the area. Additional plants were approved and control measures instituted. Enlisted inspectors were also assigned to duty in a sandwich manufacturing plant because of the large sale of sandwiches to the Army Exchange Service. At the close of the year 1944, Anti-Biological Warfare enlisted inspectors were on duty in eleven food processing plants on Oahu, three on Hawaii, two on Maui, and one on Kauai.<sup>32</sup> One inspector on duty at the small soft drink plant on Molokai had been withdrawn due to a marked decrease in the volume of products required by the Army on that island. Revision of the installations recommended for chlorination was required from time to time as troop areas were abandoned or new troop areas set up. By the end of 1944, the US Army Engineers had provided continuous chlorination for seventy-five installations. Many of the water systems required several chlorinators in order to provide an adequate chlorine residual. Two hour testing for chlorine residual in the distribution system, the use of aquariums for the detection of chemical poisons and the analysis of daily water samples for chemical poisons were all continued.

As the war progressed and offensive forces began to stage in this area, the Garrison Force Surgeon in each case was oriented in the program as it was in operation in the Hawaiian area. Such information regarding enemy intentions as was available was discussed and the possible precautions which might be required at the new base were outlined informally. Several letters of information and instruction were received in 1944.<sup>33 34 35</sup> Although the material in these publications was based largely upon material previously available or developed in the Hawaiian

Area, they served as a valuable concise source of reference in the instruction of officers who had not been oriented on the subject.

As part of the effort to learn the intentions of the enemy, blood specimens were drawn from over 1000 Japanese and Korean Prisoners of war, during August 1944 at the request of the War Department.<sup>36</sup> The specimens were shipped to the Director, Army Medical School, Army Medical Center for immunologic study.

Pursuant to a directive from higher headquarters<sup>37</sup> the Surgeon, Central Pacific Base Command, was relieved of the appointment as Anti-Biological Warfare Officer and a Chemical Warfare Officer was appointed.<sup>38 39</sup> The Medical Department continued to exercise supervision and direction over the protection of the food and the water supplies and the immunological aspects of Bacterial Warfare.<sup>40</sup> The Surgeon and his staff furnished technical advice to the Bacteriological Warfare Officer and although the Surgeon was relieved of direct responsibility, the actual amount of supervision and effort which was required remained unchanged. All formal inspections of Anti-Biological Warfare activities were made in conjunction with the Chemical Warfare Service. As of 1 January 1945, the military guards at key installations of the Honolulu Water systems were withdrawn due to the increasing demand for police personnel in forward areas. This action was taken in spite of the recommendation by the Surgeon and the Bacteriological Warfare Officer that the guards be maintained.<sup>41 42 43</sup> On 12 February 1945, the control of the sale and use of poisons and the registration of laboratories ceased to be a function of the office of Civilian Defense and became a function of the Territorial Board of Health.<sup>44 45</sup> This action was approved by Headquarters United States Army Forces, Pacific Ocean Areas, since it represented a change of policy in relations with a civilian agency. The Territorial Board of Health did not publish a directive on registration of laboratories.

From December 1941 to date, there have been changes in the designation of the Headquarters directly concerned with the administration of the Hawaiian Area. The Surgeon's Office has remained essentially the same in its organization as far as Anti-Biological Warfare is concerned throughout the change from Surgeon's Office, Hawaiian Department, to Surgeon's Office, Central Pacific Area on 14 August 1943 and to Surgeon's Office, Central Pacific Base Command on 1 July 1944. With the change to Central Pacific Base Command, the higher headquarters, Central Pacific Area and later on 1 August 1944, Pacific Ocean Areas, and on 1 July 1945, Middle Pacific Areas, assumed the responsibility for overall changes in policy affecting Anti-Biological Warfare. The actual work, however, remained in the



Central Pacific Base Command.

With the end of the war, the Anti-Biological Warfare activities are being reduced to a minimum. Certain worthwhile measures will be continued as essential to good sanitary practice. The close supervision of local food sources by frequent sanitary inspections and the chlorination of military water supplies will be continued. It is doubtful that any considerable number of civilian water systems will continue to be chlorinated. There is rather widespread public opinion against it and the cost is more than many of the local systems care to assume. The mission of the Anti-Biological Warfare effort has been accomplished. There has been no instance of the use of Biological Warfare in this Area by the enemy.

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## CHAPTER 27

### Section I

#### Sewage Disposal

##### (History of Preventive Medicine)

The disposal of human waste has been a problem since the days of the Pilgrimage of the Children of Israel from Egypt to the Promised Land. It is recorded, in the Books of Genesis, that Moses instructed the Children of Israel to go without the camp and to dig for themselves a trench and after using, to cover the same with dirt. Thus, we have a counter-part of the much used slit-trench. As man became more civilized he built for himself what we now term, "pit latrines". With the congestion of population in communities, and the use of water-borne toilets, the problem of the disposal of human waste increased materially.

Until the turn of the 20th Century, it was a common practice to discharge the sewage into the nearest convenient stream. As time passed on, men realized that the pollution of streams, which were later used for bathing, drinking, and irrigation of farm lands was very detrimental. The prevention of stream pollution, with inadequately treated sewage, is extremely important on an Island, such as Oahu, and is especially pertinent both to civilian and military establishments under the conditions existing during war times. Every effort was made to see that no sewage was discharged into streams without complete treatment, that is, primary and secondary treatment, and chlorination. In a discussion of sewage treatment in the Hawaiian Islands, the methods of disposal may be broken down into two (2) types: water-borne and non-water-borne sewers. The posts, camps, and stations can be broken down into permanent posts; semi-permanent posts; and temporary posts.

The permanent posts on the Island of Oahu, with the exception of Schofield Barracks, were making use of the sewer system of the City of Honolulu. All of the city sewers discharged into harbors or directly into the Pacific Ocean. No effort was made to treat any of the sewage. In 1943, a Sewage Committee was appointed to study the matter of sewage treatment.

In September 1943, the firm of Metcalf and Eddy, Engineers of Boston, Massachusetts, were engaged to consider and to discuss sewerage problems with the Honolulu Sewage Committee. Early in 1945, a comprehensive report was rendered by Metcalf and Eddy with recommendations for treatment of all sewage from the City of Honolulu in one sewage treatment plant. It was recommended that this plant be located somewhere in the vicinity of the Military Reservation of San Island and be of ample capacity to treat all sewage of Sand Island and Shafter Area. If, Metcalf and Eddy's recommendations are carried out, all of the permanent Army posts located in the Honolulu area will discharge their sewage through the City system to a sewage disposal plant.

Schofield Barracks and Wheeler Air Field discharge their sewage into a sewage treatment plant which consists primarily of primary sedimentation tanks, trickling filters, and final chlorination. This plant was enlarged in 1944, but all of the work has not yet been completed. The Medical Department Headquarters is making a complete sanitary survey of this plant at the present time.

Semi-permanent posts, such as station hospitals, air fields, and similar organizations, were provided with sewage treatment plants. Some of these plants gave a fairly complete treatment consisting of Imhoff Tanks, trickling filters, and chlorination. Other small units were only provided with septic tanks and chlorination.

Smaller units of the temporary type were sometimes provided with septic tanks, and cesspools, discharging into more or less, an impervious soil, which covers most of rural Oahu. In the temporary type camps, the more satisfactory type of sewage disposal was the pit latrine. A discussion of the fly control program of the pit latrine will be given at the end of this Section.

The conditions existing on the outer Islands of the Hawaiian Group were very similar to these on Oahu, with the exception of the fact that there were no existing permanent posts. A number of sewage disposal plants were constructed at various posts on these Islands. The policy of using pit latrines on smaller outposts was also in force on these Islands.

In the Spring of 1944, the Medical Department sent a sanitary engineer to the Marshall Group to make a sanitary survey of the sewage facilities in the area of the Islands of Ebeye, Roi and Namur, Eniwetok, Parry, and the Naval Air Bases.



With the occupation of Ebeye Island,<sup>1</sup> pit latrines were dug and their use was universal. However, owing to hard coral rock encountered in excavation, most of the pits were shallow and many are narrower than the latrine box, rendering them unsuitable for long continuous use. None were fly-proof. These latrines were located adjacent to the beach, whereas the brackish water wells are located along the center of the Island. The distance, due to the narrowness of the Island, between the latrine and the shallow well were not over 100 yards, resulting in pollution of the wells. It was determined that part of the Island could be accommodated with water-borne sewerage. Where water-borne sewerage is impractical, concrete vault latrines were used.

As on Ebeye, pit latrines were installed on Roi & Namur Islands<sup>2</sup> but were inadequate due to the pollution of the ground water, difficulty of fly control, and lack of space for future latrines. The construction of a general water-borne sewerage system was not considered practical. The most practical solution of the problem was the construction of concrete vault latrines. It was necessary, however, to provide a means of disposing of the excreta from the vault latrines. It was possible to locate a sewer out-fall to the sea, and cart the sewage in a sewage-truck to the out-fall, and flush out to sea.

A general plan for a water-borne sewage system on Roi & Namur was developed by the 95th Construction Battalion. There was an ingenious plan, in that it was based on the use of only those materials available locally, exclusive of concrete. It included approximately 10,000 feet of four (4) and six (6) inch pipes, on hand, and the remainder of the system consists of approximately 7,000 feet of old oil drums with heads removed and a three (3) inch lining of concrete. The disposal of sewage on Eniwetok and Parry Islands<sup>3</sup> was accommodated by pit latrines and urine soakage pits. This method was found satisfactory on Parry Island but, not satisfactory on Eniwetok. It was found that concrete vault latrines would be the only satisfactory type for Eniwetok.

In a report on sewage disposal of Kwajalein Island<sup>4</sup> the Corps of Engineers and the Medical Department recommended the use of concrete vault latrines and disposal at sea, until such time as water-borne sewage systems could be installed. A portion of a water-borne sewage system was installed in 1944, and the effluent is being discharged into the ocean.

A joint inspection of the water and sewage facilities of the Island of Saipan was made in September 1944, by a representative of the Corps of Engineers, and of the Surgeon's Office, CPBC. This report, a comprehensive plan for a water-borne sewage system for the Island of Saipan was prepared. A part of this system has been constructed, but some difficulty has been experienced in obtaining sufficient water for the proper flushing of water-borne toilets. The problem yet to be solved in Saipan is the obtaining of sufficient water for all needs, rather than the disposal of the water-borne sewage

The Medical Department did a large amount of experimental work on the control of flies in pit latrines on the Island of Oahu. In this area, *Chrysomya* and *Megacethala*, blue bottle fly, is the main breeder in pit latrines. The observations and results on Oahu were based on this species only.

Summarizing from a report,<sup>5</sup> a brief summary of the results obtained is given below:

"A single spraying of latrine buildings at a rate of 200 mg of DDT per square foot is not effective in a prolonged control when applied at the rate of four (4) ounces per hole once per week. Two (2) ounces per hole twice a week gave a satisfactory control of emerging adults. Four (4) ounces per hole twice a week did not give results sufficiently to warrant extra labor and material.

"Doses of less than two (2) ounces of 10 percent of DDT dust, used once a week, gave a satisfactory control of adults. DDT, either spray or dust, did not always bring a heavy infested latrine under control quickly enough to prevent large numbers of flies from escaping into the latrine building and beyond.

"In only a few cases did DDT prevent adult flies from emerging and escaping into the latrine buildings after the regular latrine treatments have been stopped. Three (3) weeks after treatment was stopped, there was no apparent active residual.

"Paradichlorobenzene gave complete control of fly activity in latrine pits when applied twice a week at the rate of one-fourth (1/4) pound per hole.



"Paradichlorobenzene was outstanding in performance in these tests. It was superior to DDT in that it completely prevented any fly activity, did not require equipment for application, and improved the odor of latrines in which it was used."





## CHAPTER 27

### Section II

#### Disposal of Garbage and Rubbish

##### (History of Preventive Medicine)

Prior to the war most troops were concentrated in garrison, and Army garbage and rubbish was largely disposed of by sale of the edible portions to hog raisers, and by dumping and burning of non-edible combustible and non-combustible portions on Army operated dumps and sanitary fills. Troops in congested civilian areas made use of civilian facilities as was convenient under the provisions of Engineer contracts. The dispersal of troops into field positions throughout the islands on and after 7 December 1941, resulted in the creation of numbers of scattered dumps, or in the use by troops of various established village and plantation dumps. The cooperation between the Army and civilians in the solution of garbage and rubbish disposal problems has been described in Chapter 38 on extra military sanitation. In order to assure uniformly satisfactory methods of garbage and rubbish disposal by troops on Oahu, a special directive concerning this subject was published in August 1944.<sup>6</sup> Measures for garbage and rubbish disposal on the other Hawaiian Islands have followed the same general pattern as on Oahu. Most of the edible fractions of garbage are disposed of by sale to hog farmers. That which is not, and most of the non-edible garbage and rubbish, is disposed of on dumps or sanitary fills.

In order to reduce the amount of garbage and rubbish which had to be taken by Army units to established dumping grounds, provision was made for the construction by troop labor of company size incinerators.<sup>7</sup> Many units have constructed improvised water heating facilities into the company size incinerators for shower and kitchen water. Where wood fires were used for messkit laundries some combustible matter has been disposed of in these fires.

During the latter part of 1943, two eight hour, ten ton incinerators were constructed, one at Fort Kamehameha for the Fort Kam-Hickam area and one on the upper post area of Schofield barracks. The incinerator at Fort Kam has been used satisfactorily for

the small amount of waste which has been brought to it. Responsible personnel at Schofield Barracks have never been satisfied with the performance of the Schofield incinerator. At the time of construction of the incinerator at Schofield Barracks, it was estimated that there were 48 tons of non-edible garbage to be disposed of daily.<sup>18</sup> It was proposed that 3 ten ton eight hour incinerators be constructed to be operated 24 hours a day. Any surplus waste material was to be burned on one of two dumps, one in the Field Artillery area and one on East Range. After trial with the first ten ton incinerator, the Post Commander and Post Surgeon both concurred in recommending that no additional incinerators be built during the emergency because of their limited capacity, and because of the excessive requirement of personnel and fuel required to operate them. The sanitary fill or dump was recommended as the more practical and more economical. A Board of Officers, consisting of representatives of the Surgeon, QM, and Engineer, was then appointed to study the problem of garbage and waste disposal at Schofield Barracks and elsewhere. The Board reserved decision concerning further construction of incinerators pending further trial, but steps were taken for the further development of the dump in the East Range area of the post. It was first necessary to relocate the East Range dump to a greater distance from the 13th Replacement Depot which had been constructed since the dump had been originally established. In 1945, the dump in the Field Artillery area of Schofield Barracks was closed and covered over. Since that time all non-edible garbage and rubbish from Schofield Barracks has been disposed of at the East Range dump. Animal carcasses, spoiled rations, and other large amounts of matter likely to breed flies are incinerated at the ten ton incinerator.

Edible garbage has been collected from all parts of Schofield Barracks exclusive of East Range by civilian contractors. These contractors have collected the garbage from the kitchen areas with their own trucks, leaving a clean garbage can and lid in place of the full ones. Similar arrangements have not been possible for the East Range units. The edible garbage from East Range has been acceptable to a hog farmer at some distance, but he had not had the trucks, fuel or personnel to collect the garbage. The Army has provided transportation for this garbage to the hog farm by large tank truck, in order to accomplish its sanitary disposal. Unit garbage cans have been brought by truck to a central point adjacent to the East Range dump, where the large tank truck has been loaded. During the year 1944 - 1945, the East Range garbage transfer has been steadily improved. It has been provided with all concrete surfaces, a recess for the tank truck to facilitate filling from garbage cans, a drainage system and grease trap to facilitate hosing down and sanitary disposal of liquid wastes, and in June, 1945, a soap-steam system for cleansing garbage cans was added.



With the installation of the garbage can cleaning system, all East Range units with suitable vehicles have been required to haul edible garbage to the East Range transfer point where they exchange a full can and lid for clean ones. Emptying and cleaning of garbage cans is done at the transfer point by Post Utilities. At other posts civilian contractors have collected edible garbage from kitchen areas.

Until April 1945, garbage and rubbish was hauled away from Army piers in Honolulu by the City and County of Honolulu under contract. The service was never entirely satisfactory, due to civilian labor shortages. In April, 1945, special arrangements were made with the Navy whereby the Navy was responsible for the removal of wet garbage by disposal at sea, and the Army was responsible for removal of dry garbage and trash to incinerators. In this way, no wet garbage was placed to stand on piers, and special Army trucks were not required.

On Christmas Island, edible garbage was disposed of for a time at the Island animal farm. In general, wet garbage from coral atolls has been disposed of at sea, either by garbage scow or by dumping from a short pier where there are suitable tides to carry the garbage out. Dry garbage and rubbish have been burned. On Kwajalein Island all units operate company size incinerators for the disposal of combustible garbage and rubbish and bring only products of combustion to the island dump. This material is periodically pushed off into the water by bulldozer. Screened garbage can stands were widely used in the Hawaiian Department prior to December 1942, when by revision of AR 40-205, they were prohibited. Since that time low wooden or concrete platforms have been generally used. Beginning in 1944, more and more units have constructed concrete surfaces with drains surrounded by a concrete curb in kitchen areas to serve as combined garbage can stands, garbage can washing platforms, and messkit laundry platforms. These installations have greatly improved sanitation in field kitchen areas by preventing pollution of the soil by liquid wastes. On posts they have minimized the washing of organic matter into catch basins under the streets.

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### Chapter 27

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## CHAPTER 28

### Control of Insects

#### (History of Preventive Medicine)

During the period 7 December 1941 until the latter part of 1942, there were many urgent medical problems, and routine insect control did not receive great emphasis. All troop units were expected to take mosquito control measures about their bivouacs, and periodic inspections were made, but the training of many of the newly organized units in the special problems of insect control was inadequate. No entomologist was assigned to the Surgeon's Office, Hawaiian Department. Adult mosquitoes were quite numerous, both during the day and night. However, considerable attention had been directed to the problem to the problem of preventing the introduction of new insect vectors of disease into the Hawaiian Islands. An organization for the disinsectization of military aircraft after flights originating outside the Territory, had been built up by the Army with the assistance of the U.S. Public Health Service, the U. S. Department of Agriculture, and the Hawaiian Sugar Planters' Association. (See chapter on foreign quarantine).

Late in 1942, it became evident that much of the mosquito breeding which resulted in annoying numbers of mosquitoes on posts and throughout the City of Honolulu resulted from standing water in bomb shelters. These shelters had been constructed in 1942, but except for practice aid raid alerts they had not been used. A directive was published calling the attention of commanding officers to the proper maintenance of bomb shelters.<sup>1</sup>

In September, 1942, a request was received from the Commanding General, Hawaiian Antiaircraft Artillery Command, for the issue of a mosquito repellent for searchlight, sound locator, and radar crews who were located in mosquito infested areas.<sup>2</sup> The use of mosquito head nets by these troops was not desirable, because of the keen uninterrupted visual and aural perception required. A quantity of oil of cintronella was purchased for the preparation of mosquito repellent creams to meet this need. Staway had been available in the Territory in 1941, on a commercial basis, but stocks were completely used up. It was not known at the

time that Sta-Way was toxic.

When Christmas Island was occupied in late 1941, there were no mosquitoes present on the island. Mosquitoes (*Culex quinquefasciatus*) first appeared in May 1942, probably introduced by aircraft.<sup>3 4</sup> More attention was given to the disinsectization of aircraft arriving at the base thereafter, but the mosquitoes have maintained themselves on Christmas Island up through 1945. Mosquito control measures have been instituted without complete eradication. In late 1943, interest in mosquito control at Christmas Island was increased when the British Government brought in a group of filariasis infected Gilbert and Ellice Island natives to harvest the copra. At the request of the Island Commander, a trained entomologist was sent to Christmas Island to make a survey and make recommendations as to control measures.<sup>5</sup> Following this, top feeding minnows were sent to Christmas Island, in order that they might be established in the many lagoons and ground pools. The fish arrived in good condition in May, 1944,<sup>6</sup> but their present status is not known.

An entomologist was assigned to the Surgeon's Office, Hawaiian Department, 3 April 1943.

In April, 1943, the Surgeon, Hawaiian Department, requested authority to conduct a mosquito survey to determine the possible presence of *Anopheles* mosquitoes in the Hickam Field - Pearl Harbor area. This survey was considered necessary as a check upon the efficiency of the disinsectization program for aircraft, and to provide data on conditions existing in the area should it be necessary to undertake a program of *Anopheline* mosquito eradication in the area. Authorization was approved, and work began 19 April 1943. No *Anopheline* mosquitoes or other mosquitoes previously unknown in the Territory were found.<sup>7</sup>

During the survey of the Hickam Field - Pearl Harbor area it was reported that there was more mosquito breeding in military than in civilian areas, and that septic tanks, fire barrels, and salvage yards were the worst offenders. Based upon this information Section V, Mosquito Control Circular No. 75, HHD, dated 8 June 1943, was published.<sup>8</sup>

The history of this epidemic and the associated *Aedes* mosquito control program in extra military areas throughout the Territory is included in Chapter 34, Arthropod-borne Infections and Chapter 38, Extra Military Sanitation and Liaison (U.S. Public Health Service). In order to assure *Aedes* mosquito control on military reservations during the dengue fever epidemic, all commanding officers in August



1943, were directed to institute a survey and control program for the control of mosquito breeding within a radius of one-fourth mile of buildings occupied by troops.<sup>9</sup> Where civilian habitations or other premises used by civilians were within the one-fourth mile radius, troops were authorized to call upon the Territorial Board of Health for assistance. Very few cases of dengue were traced to infection in military areas on Oahu.

Approximately two months after the Gilbert's Campaign and the occupation of Makin Atoll by an Army garrison, a severe outbreak of dengue fever occurred involving almost every member of that garrison. Neither of the two recognized vectors of dengue fever (*Aedes albopectus* and *Aedes aegypti*) were found on Makin. Two mosquitoes were present in large numbers, *Culex quinquefasciatus* and *Aedes variegatus*. In March, 1944, an enlisted medical technician was sent by the Department Surgeon to Makin Atoll to organize a mosquito control program for the garrison. This technician was exceptionally well qualified, and a comprehensive and successful program resulted.<sup>10</sup> About this same time numbers of troops began returning to the Hawaiian Islands from Makin Atoll who were ill with dengue fever on arrival, particularly Air Corps personnel. The control program on Makin became important in reducing the danger of reintroduction of dengue virus to the Territory of Hawaii, where control measures had made great progress. To further safeguard the Territory, a directive was published in March, 1944, again reminding all commanders of the necessity of continuing *Aedes* mosquito control measures in and about troop areas.<sup>11</sup> Troops arriving in the Hawaiian Islands from Makin by ship were put in three day quarantine, or until it was ascertained they were dengue free. It was necessary to rely on the Air Corps to maintain medical surveillance over their own personnel. During this period the *Aedes* mosquito control program in Honolulu was being expanded to include all of the Hawaiian Islands (See Chapter 38).

One of the major insect control problems in the Territory of Hawaii was fly control in the many hundreds of pit latrines at training camps, staging areas, and field positions. The small pit latrines dug at the field positions of the many units in defense of the islands, seldom over eight feet deep, were relatively easy to maintain fly-free. The pit latrines provided for the larger camps, however, were provided with enormous pits, 15 to 20 feet deep and approximately 10 by 15 feet in cross section. These large latrine pits had been provided with tight boxes and screened latrine houses, nevertheless, difficulties occurred almost at once in the control of flies in them. The faithful application of 3-5

gallons of crude or waste motor oil to the pit contents each day was effective, but the latrine seats soon became soaked with black oil. The general quality of soldier selected for permanent latrine orderly, or the equally unsatisfactory use of all company personnel as orderlies on roster made it difficult to assure continuous oiling with crude oil, or to keep sprayers in working condition for the economical use of diesel oil. Units moved in and out of these training camps frequently, and the camps were vacated for periods of time during which they were maintained by station complements of a few men. The large pit latrines required continuous fly control maintenance, whether they were in current use or not. The predominant species of latrine fly in this area, *Chrysomya megacephala*, has continued to breed in great numbers for 3-4 weeks after a large latrine has been left unattended. After this period, the soldier fly (*Hermetia illucens*) has bred in the older feces for a longer period. So great was the sanitary need for better fly control in the large latrines that the Department Surgeon called his consulting entomologist and directly ordered him to find a solution for the fly problem. The result was the trial and development of the use of paradichlorobenzene. The credit for the introduction of paradichlorobenzene into military sanitation for the control of fly breeding in pit latrines belongs to Major (then Captain) Franklin Sherman III, Sn C, of this Headquarters. Considerable experimental trial with paradichlorobenzene in these large pit latrines followed. The chemical was successful, economical, and so easy to apply that the simplest latrine orderly could use it. The Department Surgeon expressed his satisfaction with the results obtained with PDB in a letter to The Surgeon General, dated 22 March 1944.<sup>12</sup> Later, some limitations to the effectiveness of paradichlorobenzene were found. It was not so effective where latrine pits contained standing water, where the pits were less than six feet deep, or where a draft was created in the pit through faulty covering by the latrine house.<sup>13</sup> Extensive practical trial of paradichlorobenzene in the Hawaiian Islands was not possible until 1945. Up to this time almost all paradichlorobenzene shipped to the Pacific was reserved by higher headquarters for use at advanced Pacific bases. The large pit latrines for which the chemical had been developed were treated with crude oil, diesel oil, and later, 5% DDT in kerosene. A sufficient quantity of paradichlorobenzene was available in 1945, to permit its routine use in the Hawaiian Islands. Instructions concerning procurement and use were published.<sup>14</sup> At present both paradichlorobenzene and 5% DDT in kerosene are being used to control fly breeding in the large latrine pits. Of the two, the paradichlorobenzene is the simpler method, provided the pits are deep, do not contain standing water, and are protected from drafts.



The campaign in the Gilbert Islands had been followed by an indescribable fly problem. Adult flies were everywhere, even to the point of swarming over food as it was being passed to the mouth. Bacillary dysentery spread through entire garrisons. the fly breeding had taken place in enemy dead, in destroyed enemy ration dumps, and in both destroyed enemy and unsanitated friendly latrines and garbage accumulations. In early 1944, the Marshalls Campaign was imminent. It was to be carried out under top Navy Command (Fifth Amphibious Corps). Through Army-Navy liaison, once again Capt. Sherman was called upon to provide an answer. The effectiveness of sodium arsenite as a fly and maggot killer was first demonstrated to the satisfaction of the Army and Navy staff through experiments with fly-blown meat.<sup>15</sup> Thereafter, the development of the possibility of using sodium arsenite for battlefield sanitation from the supply and logistical standpoints was an easy matter. Chemical warfare decontaminating trucks were selected to spray the dilute sodium arsenite solution, and the necessary trucks and personnel were included in the operation. Personnel were selected from the combat teams and garrison forces to act as burial details. These personnel were trained in the preparation of sodium arsenite solution, the spraying of sodium arsenite from knapsack sprayers, and the necessary precautionary measures to be taken with this violent poison. Protective lotions were prepared for the skin of personnel handling and spraying sodium arsenite.<sup>16</sup> Capt. Sherman participated personally in the Marshalls Campaign to supervise the fly control work. Results were good, and sodium arsenite has been used in all successive Pacific operations where intensive fighting has taken place on small land masses. A directive concerning the use of sodium arsenite,<sup>17</sup> and two papers concerning the use of sodium arsenite under battlefield conditions are noted.<sup>18 19</sup>

Mosquitoes did not become the problem on Kwajalein that they had been on Makin. Kwajalein Island was completely levelled by artillery, and generally, conditions have not been as favorable for mosquito breeding in the Marshalls as they have been in the Gilberts.<sup>20</sup> Debris was cleared away rapidly. No cases of dengue occurred which were traced to infection at Kwajalein. No extensive outbreaks of dysentery occurred at Kwajalein as they had in the Gilberts.

Bedbug infestation was recognized as a serious insect control problem in the Hawaiian Department in late 1942, when an inspection of Schofield Barracks showed bedbug infestation in a large number of units. With the frequent transfer of troops, bedbug infestation spread to almost all military posts. Control measures

were used generally, but indifferent units were a handicap to good ones. The temporary light wooden construction used predominantly for barracks became infested with bedbugs, was difficult to fumigate, and served as a source of reinfestation after cots, bedding, and personal effects were treated. The year around, uniformly warm climate gave the bedbug every advantage for growth and reproduction. It invaded the laundries and travelled in clean linen and blankets. It persisted on cots and blankets returned to supply rooms and Quartermaster warehouses, and it invaded the new units to which these items were reissued. Much effort was expended to overcome this infestation without success until there was a sufficiently intensive, coordinated effort by all units under the supervision of a permanent detail of insect control specialists. This coordinated effort was successfully undertaken in the latter part of 1944 before DDT was available in quantities sufficient to permit its use for bedbug control. Since DDT has been available for bedbug control there has been no problem. A chronological history of bedbug control in the Hawaiian Department follows:

1. Bedbug control measures were left up to individual units throughout 1942 and 1943. Bedbug infestation was generalized and very little permanent progress was made.<sup>21</sup> All the time-honored methods of eradicating bedbugs were used,<sup>22</sup> but the nature of the buildings and the lack of concerted efforts by all units, frequently repeated, doomed the efforts to failure. Large numbers of cots and mattresses were fumigated in stationary and portable gas chambers and steam sterilizers only to become quickly reinfested.<sup>23</sup>
2. In March, 1944, a central Army Pest Control Section under the Army Port and Service Command, was set up to coordinate insect control measures among the various Army units and to provide technical advice and assistance where necessary.<sup>24</sup> A vigorous program of bedbug control was undertaken under the leadership of this organization.<sup>25</sup> Nevertheless, bedbug control continued to be a major problem. There were too many bedbugs on the five major Hawaiian Islands for one pest control organization to handle, and the cooperation and training of the troops in bedbug control was not sufficient.
3. In August, 1944, a bedbug control school was conducted on Oahu, attended by three officers from each of the



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major echelons of the Central Pacific Base Command. The school occupied two days, and included demonstrations of fumigation with methyl bromide and hydrogen cyanide. However, the bedbug control method stressed was the "Unit Clean-up Method", the procedure for which was mimeographed and distributed at the school. The unit clean-up method was later published as a Central Pacific Base Command directive, subject: Bedbug Eradication Drive, 15 October 1944.<sup>27</sup> The unit clean-up method as applied in the bedbug eradication drive was very successful. However, beginning in September, 1944, the remarkable effectiveness of DDT in bedbug control was recognized in the Central Pacific Base Command, and control measures since instituted have consisted in the spraying of cots, mattresses, and barrack walls with 5% DDT in kerosene. Several comprehensive reports on bedbug control concerning the unit clean-up method and DDT have been included in Essential Technical Medical Data reports of the Central Pacific Base Command.

Cockroaches have been a problem in the Hawaiian Islands when adequate control measures have not been taken. During the first two years of the war many units employed commercial insect control firms for cockroach control using unit funds. With the establishment of the Army Pest Control Section in March, 1944, this section gradually displaced the local firms. Because of the possible danger attending the use of sodium fluoride, DDT is used almost exclusively for cockroaches and with equal success. Much of the work of application of an insecticide is done by insect control technicians of the Army Pest Control Section, but troops prepare kitchens, mess halls, storerooms, and barracks in such a way that food and utensils are protected or removed, and spraying can be done rapidly.

Lice have not been a problem, either in military or civilian personnel. Delousing of prisoners of war has been accomplished as required by quarantine directives. Fleas have only been a problem where an excessive number of dogs and cats have been accumulated by troops in military camps. DDT powder in talc has been effective against fleas. Bird mites are occasionally a problem in buildings where Minah birds have nested in the eaves or attics. When the parent birds and young leave the nests the mites migrate down through the building in unbelievably large numbers seeking sustenance from human beings, and causing irritating bites. Treatment with standard insecticides, eradication of nests, and prevention of further nesting have been invariably successful control measures. Chigger bites have not been noted. Ticks have

been an occasional problem among war dogs. Ant infestation has been a frequent and very difficult problem of no medical or sanitary importance.

A copy of CPBC Administrative Order No. 1 (Index CPYSG 200.30), Control of Insects, 10 July 1945, is inclosed.<sup>28</sup> This publication incorporates minor changes made in an order published 6 February 1945. Similar administrative orders concerning disinsectization of mail and baggage rooms and salvage tires have been reported in Chapter 40 on Foreign Quarantine.

Several thousand Okinawan prisoners of war were received on Oahu from Okinawa on 13 July 1945. Immediate action was taken by the 18th Medical General Laboratory and three malaria survey detachments to survey these prisoners for diseases of possible danger to the Command. Among other infections these prisoners were found to be approximately 20% carriers of microfilaria of *Wuchereria bancrofti* and *malayi* in the blood. The Prisoner of War Compound was situated in a rural area on Oahu where a considerable population of *Culex quinquefasciatus* mosquitoes existed. The dangerous nature of this situation was immediately recognized. *Culex* mosquitoes captured while biting infected Okinawans showed 10% infection with microfilaria larvae.<sup>29</sup> Later, the complete larval transformation to the infectious larvae was observed in these mosquitoes in the laboratory. Other mosquitoes captured at large in the prisoner compound were found to contain larvae on dissection. Bite counts taken in the prisoner compound area were as high as 22 *Culex* per 10 minute period per collector. Breeding was observed to be heavy in a stream of shower and kitchen waste water which ran in an open ditch through the camp. Because of the danger to guard personnel, civilians in adjacent areas, and uninfected prisoners, energetic *Culex* mosquito control measures were taken. Careful individual protective measures were taken by guard personnel. The stream was sprayed with 5% DDT in kerosene by knapsack sprayers, and further treated by drip and ball oilers utilizing 5% DDT in kerosene with complete success. The entire camp area and surroundings were then surveyed by a malaria survey detachment, and a few additional mosquito breeders were eradicated. The blood surveys were completed as rapidly as possible, and infected prisoners were transferred to one area of the camp where they were situated in tents equipped with mosquito bars. Tents, cots, and mosquito bars had been treated with 5% DDT in kerosene. All camp tents were sprayed, and all prisoners were provided with DDT treated mosquito bars as rapidly as possible, although supervision of their use was most careful among the known infected prisoners. Brush and grass in the compound and surroundings was cut close to the ground by prisoner labor. Adult



mosquito resting places were determined to be beneath buildings, under bridges, along ditch walls, and in high grass. Adult resting places were sprayed with 5% DDT emulsion in water by means of two truck-borne power sprayers.. An area of approximately one mile by one-quarter mile was as thoroughly sprayed with DDT emulsion as possible for residual effect against adult mosquitoes in harborages. Within approximately one week, bite counts taken over the entire area showed a total of only one mosquito collected during 12 collecting periods of 10 minutes each. Precautions were taken to prevent Okinawan prisoners spreading filariasis to areas outside their compounds by limiting working hours to the period of the day when the *Culex quinquefasciatus* mosquito rarely bites and by requiring mosquito control in prisoners' work areas.

Except for a few experimental sprayings over military reservations or waste lands on a small scale no spraying of DDT by airplane has been carried out in the Hawaiian Islands. There is strong opinion among local civilian entomologists and planters that the widespread use of DDT in the Territory would cause catastrophic upsets in the established biological insect balances. The use of airplanes to spray DDT for *Culex* control in the filariasis infected Okinawan prisoner compound was considered, but the idea was abandoned in respect for local civilian opinion. The control measures taken from the ground were undoubtedly more time consuming than airplane spraying would have been, but were probably more effective.





Headquarters,  
CENTRAL PACIFIC BASE COMMAND,  
18 May 1945

ADMINISTRATIVE ORDER)  
NUMBER 1)

(Index CPYSG 204.20) THE USE OF PARADICHLOROBENZENE (PDB) FOR  
FLY CONTROL IN PIT LATRINES

1. General. Paradichlorobenzene (PDB), a chemical for use in controlling flies in pit latrines, is now available for issue by the Quartermaster.

2. Technique. Since the effectiveness of PDB depends upon the formation in the latrine pits of a gas which kills all stages of the fly, latrine boxes must be as gas tight as possible. The following measures must be observed:

a. All cracks and knot holes must be chinked or tightly covered.

b. Seat lids must fit tightly and remain closed when not in use.

c. Fly traps must not be placed over seat holes; and if the latrine has a built-in escape to a fly trap, this opening must be closed.

d. Earth or sand must be banked around the base of the box or latrine building.

e. The practice of "burning out" latrines and the use of oil or other chemicals must be discontinued when latrines are treated with PDB.

3. Dosage.

a. PDB is applied by scattering the crystals, by hand, over the surface of contents of the pit. It is desirable that all pits be at least six (6) feet deep in order to obtain control of the fly with PDB. PDB will not vaporize under water and is therefore not effective when scattered in a pit in which the contents are completely covered with water. In the event that the use of PDB is begun in latrines already infested, the initial dose of PDB should be doubled. Applications must be made twice weekly, and in the following quantities.

(1) Semi-permanent latrines, with covered latrine houses:

- (a) 12-seat latrine . . . . . 3 pounds PDB
- (b) 8 - 10 seat latrine . . . . . 2 pounds PDB
- (c) 4 - 6 seat latrine . . . . . 1 pound PDB
- (d) 2--seat unit . . . . . 1/2 pound PDB

(2) Temporary uncovered QM type latrine boxes:

- (a) 6-8-seat unit . . . . . 3 pounds PDB
- (b) 4-seat unit . . . . . 2 pounds PDB
- (c) 2-seat unit . . . . . 1 pound PDB

d. The dosage of PDB required for good fly control may vary from that listed above, depending upon the size of the pit and the tightness of the latrine box. The larger the pit and the more loose the construction of the latrine box, the greater will be the dosage required. An inspection of the pit contents for fly maggots should be made with the aid of a flashlight each time a treatment is applied. If maggots persist during the twice-weekly application, a higher dosage of PDB is indicated.

4. Application by special detail. In each camp where pit latrines are to be treated with PDB, a special detail should be organized to apply the chemical, with the policing of latrines remaining a unit responsibility.

5. Storage of PDB. Because PDB volatilizes at normal temperatures, it should be stored in an air tight container in a cool place.

6. Basis for requisition. Issue will be made upon the basis of twenty (20) pounds of paradichlorobenzene (PDB) monthly per one hundred (100) men. Where the above basis of issue is found to be insufficient under local conditions, requisitions for larger quantities will show a statement fully describing the circumstances underlying the increased requirement.

BY COMMAND OF MAJOR GENERAL BURGIN:

OFFICIAL  
/s/ M. W. MARSH  
Colonel, GSC  
AC of S, G-4

Wayne C. Smith  
Brigadier General, GSC  
Chief of Staff

Distribution: "C" plus POA "C" less 9 & 10  
Special (50 copies, Surgeon, CPBC).



Headquarters,  
CENTRAL PACIFIC BASE COMMAND,  
15 October 1944

ADMINISTRATIVE ORDER)  
NUMBER . . . . .)

(Index 700.30)      BEDBUG ERADICATION DRIVE

1. The irritation caused by even a light infestation of bedbugs reduces vitality of men and lowers the morale of units infested. Many cases are known where clean house-keeping by certain Army units has entirely eliminated bedbug infestation. It has also been observed that such units are efficient and alert from the commanding officer down to the last man. To eliminate bedbugs entirely, it is necessary that eradication in an area at one time is accomplished so that re-infestation of the unit is less likely to occur by movement of the unit or by the transfer of men from one unit to another. The attached leaflet "Bedbugs and Their Control in the Army" was compiled to familiarize all concerned with the habits and control measures which enable a unit to find and eliminate an infestation.

2. It is directed that unit commanders explain or read this leaflet to their units and make a thorough inspection to detect any possible infestation of bedbugs.

3. If any infestation whatsoever is found, the following clean-up control measures will be thoroughly accomplished in a single day for the entire unit:

a. All bedding material such as blankets, pillows, sheets, mattresses, and all clothing will be aired in the sun.

(1) All bedding and clothing will be shaken out, examined, and any bedbugs destroyed.

(2) Mattresses will be examined and brushed with a stiff scrubbing brush in order to kill any bedbugs or eggs present.

b. Canvas cots will be folded carefully so as not to disturb the bedbugs and dipped in hot water as near the boiling point as possible for two or three minutes. Steel cots will be scalded with hot water, painted thoroughly with kerosene or disinfected with a blow torch. (The torch flame being very hot need only touch a bedbug or egg to kill it instantly.)

c. Walls will be painted with kerosene or washed down with boiling water making sure that killing agent penetrates all cracks and crevices where bedbugs hide.

d. Floors will be scrubbed with boiling water and soap.

4. The clean-up measures will be repeated at weekly intervals for three treatments. If, at the end of that series, signs of bedbugs are evident, treatments will be continued until all infestation is eliminated. Frequent inspection will be continued in order to detect any new infestation.

5. Unit commanders will require new men joining the unit to shake out and examine their equipment for bedbugs and disinfest the equipment when necessary before entering sleeping quarters.

By command of Major General BURGIN:

WAYNE C. SMITH,  
Colonel, GSC,  
Chief of Staff.

OFFICIAL:

/s/ M. W. Marsh  
M. W. Marsh  
Colonel, GSC,  
A C/S - G-4

1 Incl: Leaflet "Bedbugs and Their Control in the Army".

DISTRIBUTION: "C"  
Surgeon (50 copies - Special)



## BEDBUGS AND THEIR CONTROL IN THE ARMY

### INTRODUCTION

The crowded conditions in the Army under war conditions and the frequent movement of individual men as well as units provide ideal conditions for the propagation and dissemination of certain insect pests. This is especially true in areas where the temperature is high enough the year round for the continuous life processes of the pest. Insects are known as cold-blooded animals and become sluggish and inactive as the temperature goes down, laying fewer eggs, feeding less often, and even hibernating in extremely cold weather. On the other hand, as the temperature rises, insects feed more often, lay eggs faster, and finish their life cycle in a shorter time. The bedbug is such an insect and in the Central Pacific Area where the temperature is always favorable they multiply very rapidly. Only about six (6) weeks are required to complete the life cycle under favorable conditions.

There is a comic poem which ends with this line, "The bedbug has no wings at all but it gets there just the same." The bedbug depends entirely on man to scatter it from place to place. They crawl only short distances. The urge to crawl is stimulated by the odor of a person nearby on which the insects feed. The bedbug is nocturnal in habit, that is, it is active only at night ordinarily and spends the day resting in protected places such as in folds or seams of bedding or mosquito netting or in cracks or crevices of the bed or nearby walls. The female full of eggs has a particular desire to "go places" and is ordinarily the only form which is active in day time. Thus we see that it is the female ready to lay eggs which is most likely to be carried from place to place on clothing and other articles.

The crowded housing conditions and continual movement of armed forces under war conditions provide perfect conditions for the propagation and dissemination of the bedbug. The crowded conditions in living quarters make it necessary for the bedbug to travel only a few feet to find a luscious sleeping man on which to feed. Frequent transfers of from one man to whole units of men provide the vehicle of dissemination making it unnecessary for the bedbug to have wings. The equipment of men joining units should be inspected thoroughly so that infestation may be prevented. Units moving into quarters previously occupied should be especially alert to determine if the

quarters had previously been infested. Units leaving quarters should make every effort to leave such quarters free from bedbugs. These are only a few of the many ways which army routing aids in disseminating bedbugs.

#### DESCRIPTION AND HABITS

The mature bedbug is a wingless brown insect about one-fourth to three-eighths of an inch long. Unless engorged with blood it is paper-thin which enables it to hide in cracks or crevices in the bed or walls.

When first hatched the nymph is translucent with a yellowish tinge and feeds at the first opportunity. It molts or sheds its skin five times before reaching maturity, which takes from 4 to 6 weeks in warm weather. It must feed after each molt. at 82°F to 89°F newly hatched bedbugs have lived unfed up to 18 days. At 60°F to 65°F they have lived 136 days unfed and 9 months when given a chance to engorge once. When normally fed, and laying eggs, individual bedbugs have lived from 54 to 316 days.

The eggs are white, about one thirty-second of an inch long. They are oval elongate with one end constricted to a short bottle neck at the end of which the hatching nymph emerges. When first deposited the egg is covered with a mucilaginous substance which sticks to the surface on which it is laid. From one to five eggs are laid per day by one female. A single female has been known to deposit over 500 eggs but around 200 is probably the average. The eggs hatch in from 6 to 28 days depending upon the temperature.

#### THE DETECTION OF INFESTATION

The usual place to locate bedbug infestation is on those beds which show the disfiguring spots of excrement near the joints or crevices where the insects hide. There may also be whitish areas of eggs or egg shells. These can be seen with the naked eye. A light infestation may be discovered by searching around the tufts and seams of the mattress. However, if the bedbugs are disturbed by haphazard control measures or become more numerous they establish themselves in the walls, behind baseboards, or in window and door casings.

#### CONTROL MEASURES

Control measures against the bedbug should be thorough and concerted. Eradication can only be accomplished by simultaneous, thorough efforts in a whole area. These simultaneous control measures should be repeated at weekly intervals until eradication is complete. After



eradication is thought to be complete frequent inspections should be made and the men instructed to report the discovery of any trace of infestation. When it is thought that one is annoyed by bedbugs they can often be found by aid of a flashlight at night, and the bedbug captured for identification.

#### SUPER-HEATING AND HOT WATER

Boiling water will kill any stage of the bedbug instantly upon thorough contact. The liberal use of GI soap in the water is also recommended. Dry heat at 120°F for several hours will kill all stages. Steam sterilization of mattresses is very effective. Canvas cots dipped in a barrel containing water too hot in which to hold the hand will kill all stages of the bedbug which may be on the cot in a minute or two if the water contacts the insect or egg. The cot may be lowered into the hot water by means of a rope. The hot water must reach all crevices. Scalding water may be poured on a metal bed but care must be taken to hit all places the bedbugs may hide. The hollow parts of the metal frame serve as excellent hiding places and for the laying of eggs.

The blow torch will clean a metal bed of infestation. The torch flame, is several hundred degrees fahrenheit, and all stages of the bedbug hit by the flame are killed instantly so that the flame need not be held on coil springs long enough to affect the temper of the spring. The inside of the coil spring is most liable to contain bedbugs or eggs. The hollow parts of the frame should not be neglected.

#### INSECTICIDES

Any of the common contact insecticides will kill any stage of the bedbug but it must be remembered that the egg or bedbug must be wet with the material. The common atomizer spray gun does not throw enough material for thorough work on a large scale but if diligent work is done an individual bed and adjoining walls may be disinfested if an initial infestation is thought to be localized. It cannot be overemphasized, however, that thorough work and community effort is necessary to eliminate infestation entirely. The Quartermaster insect spray which contains lethane mixed with white kerosene is a good spray to use in wetting walls and spraying equipment including steel cots. All stages of the bedbug will be killed if wet with plain kerosene but the white grade kerosene should be used. The odor also has a repellant effect. Kerosene may be applied with a paint brush if a mechanical sprayer is not available.

## FUMIGATION

Where whole buildings are heavily infested and if the building can be made gas-tight a most efficient way to eliminate infestation is to fumigate with hydrocyanic acid gas, methyl bromide, or chloropicrin. Each of these gases has its advantages under certain conditions. Each gas is deadly to man and should be used by persons familiar with using such a gas.

The pest Control Unit of the C&U Branch of the Army Port and Service Command will aid in formulating plans for eliminating bedbugs. It is believed, however, that with the suggestions given above the unit commander with the advice of his medical officer can rid his unit of bedbugs.



Headquarters  
CENTRAL PACIFIC BASE COMMAND  
10 July 1945

ADMINISTRATIVE ORDER)  
NUMBER 1)

(Index CPYSG 200.30) CONTROL OF INSECTS

\*1. Rescission. Administrative Order No. 1 (Index 200.30), HCPBC, subject as above, 6 February 1945, less inclosure 1 thereto (Leaflet "Bedbugs and Their Control in the Army").

2. Technical Advice and Assistance in Control of Insects.

a. An Insect Control Section, which will provide technical advice and assistance in the control or eradication of bedbugs, cockroaches, lice, termites, and other vermin and insects, has been established in the Army Port and Service Command. The services of this Insect Control Section are available to all Army units and include the furnishing of material, equipment, and supervisory personnel necessary in executing control and eradication measures. COMMERCIAL INSECT CONTROL FIRMS WILL NOT BE HIRED.

\*b. Army units desiring the assistance of this unit, will initiate a written request through channels to the Commanding General, Army Port and Service Command. This letter will give the type of pest, extent of infestation, size and location of buildings or areas, date control measures may be taken, and any other pertinent information. For service for units needing immediate assistance, the Insect Control Section may be reached by telephoning Kapalama 186 or Fort Ruger 696 or 1314.

c. A representative of the Insect Control Section will make an inspection of the infested building or area and will make recommendations or arrangements for remedial action. In general, the Insect Control Section will furnish materials, such as poisons, insecticides, tools, equipment, fumigation vaults, and supervisory personnel only. Troops will furnish the labor necessary for moving of bedding and furniture, prepare the building or area for treatment, and provide guards to prevent unauthorized entry into buildings.

d. Upon completion of control measures, the requesting authority will inspect buildings or areas treated to determine effectiveness of control measures. If control measures were not effective, a report to that effect will be made immediately to the Commanding

General, Army Post and Service Command.

\*3. Insecticides and Pest Control Equipment. Authorization for and allowances of insecticides and items of pest control equipment are indicated in Circular 163, WD, 4 June 1945.

4. Control of Bedbugs. (See inclosure, pages 91 to 94.)

a. The irritation caused by even a light infestation of bedbugs reduces vitality of men and lowers the morale of units infested. Many cases are known where clean housekeeping by certain Army units has entirely eliminated bedbug infestation. The attached leaflet "Bedbugs and Their Control in the Army" was compiled to familiarize all concerned with the habits and control measures which enable a unit to find and eliminate any infestation.

b. If any infestation whatsoever is found, prompt control measures will be taken:

\*(1) Use of DDT. DDT is the method of choice. When DDT is available, its use for control of bedbugs is recommended. Allowances for troops stationed in the CPBC are as set for Pacific Ocean Areas in Circular 163, WD, 4 June 1945. Experience has shown that a single application of a sufficient amount of DDT to beds, mattresses and walls of barracks will control bedbugs for several months. DDT is issued as a 5% solution in light petroleum oil, (Insecticide, spray, DDT, residual effect), or as a 10% dust mixture in talc (Larvicide, DDT, powder, dusting or Insecticide, powder, louse (DDT)). Application is as follows:

\*(a) Insecticide, spray, DDT, residual effect (QM Item 51-I-305) is applied by knapsack, (Engr. Item 41-7839.400.030) continuous hand (QM Item 41-S-4105), or other suitable sprayer to beds, mattresses and adjacent barrack walls at a rate of approximately 6 gallons per 100 beds. A fine wetting spray is the most desirable type. Mattresses and beds should be set up and sprayed so that excess material not deposited on them will be deposited behind them on the walls. Walls may be given additional treatment to a height of 6 feet, with particular attention being given to cracks and crevices.



\* (b) Larvicide, DDT powder, dusting (QM Item 51-L-122) or Insecticide, powder, louse (containing DDT) (Item 51-I-173 and 180) can be applied by shaking from the 2 ounce can (QM Item 51-I-173) or by use of duster, powder, insecticide (QM Item 41-D-3755). Powder should be dusted on mattresses, particularly about the tufts, and into crevices on the beds and walls.

(2) Unit Clean Up Method: When DDT is not available, the following clean up control measures will be thoroughly accomplished for the entire unit in a single day and will be repeated at weekly intervals for at least three treatments:

- (a) All bedding material such as blankets, pillows, sheets, mattresses, and all clothing will be aired in the sun.
  - 1. All bedding and clothing will be shaken out, examined and any bedbugs destroyed.
  - 2. Mattresses will be examined and brushed with a stiff scrubbing brush in order to kill any bedbugs or eggs present.
- (b) Canvas cots will be folded carefully so as not to disturb the bedbugs and dipped in hot water as near the boiling point as possible for two or three minutes. Steel cots will be scalded with hot water, painted thoroughly with kerosene or disinfested with a blow torch. (The torch flame being very hot need only touch a bedbug or egg to kill it instantly.)
- (c) Walls will be painted with kerosene or washed down with boiling water making sure that killing agent penetrates all cracks and crevices where bedbugs hide.
- (d) Floors will be scrubbed with boiling water and soap.

c. Treatment for bedbugs will be continued until all infestation is eliminated. Frequent inspections will be made in order to detect any new infestations. Unit commanders will require new men joining the unit to shake out and examine their equipment for bedbugs, and disinfest the equipment when necessary, before entering the barracks.

## 5. Control of Cockroaches.

a. Cockroaches are among the most annoying and objectionable insects infesting Army units. They are a menace to sanitation, and result in the destruction and pollution of food. Not only may they become numerous in mess halls and latrines but also in officers' clubs, post exchanges, hospitals, and other places where food is stored or prepared. Since they are active mostly at night, large numbers may develop in a building before they are known to exist. These pests thrive on filth and moisture and feed on food products, waste food, and even book bindings and leather. The contaminate food they touch and often cause an obnoxious odor.

b. Cockroaches in this area are mainly of three species. The small tan German roach which is most common, is  $3/8$  to  $3/4$  inch long, the dark brown American roach is 1 to  $1\frac{1}{2}$  inches long and the black Oriental roach is about one inch long. The German and American roaches have well developed wings, while the Oriental cockroach is nearly wingless. Several different kinds of roaches may infest a place at the same time. They may be noticed around sinks, drains, plumbing fixtures, and other dark and damp places. Food is usually sought at night and it is customary for roaches to hide in crevices in the daytime or when personnel are working around areas that roaches inhabit. The German cockroach is frequently brought into the building with boxes of groceries; American and Oriental cockroaches frequently live in nearby sewers or other places of concealment, entering the building only at night to feed.

c. Eggs are deposited in capsules of about 20 to 30 eggs per capsule. The capsules are often carried for several days protruding from the female's body and are dropped in secluded places or may be found sticking to shelves or walls or even the ceiling. Upon hatching, the young appear much like the adults except they do not have wings and are much smaller. They molt several times and feed for several months before becoming adult. This long period of feeding and development gives ample time to kill them by dusting before the young mature and begin to reproduce.

\*d. All species of cockroaches may be controlled by the use of Sodium Fluoride powder and a dust gun, both of which are listed as an item of issue in Circular 163, WD, 4 June 1945, under the following stock numbers: 51-I-210, Insecticide, powder, roach; 41-D-3755, Duster, powder, insecticide. This material should be carefully dusted into all cracks and crevices in the area being treated with special emphasis on common hiding places, such as under tables, drain boards, sinks, shelves, grease traps, or other places where inspection reveals that the roaches are congregating.



e. The dust kills by contact with the roaches or as a stomach poison. In killing as a stomach poison the roaches get the dry dust on their feet and other parts of the body and clean these parts with the mouth parts thus ingesting the poison. As long as the dust is dry is effective but as soon as it becomes wet and caked, it is ineffective because the roaches cannot pick it up on their feet.

f. Sodium fluoride is poisonous to man if taken internally. Therefore, extreme care should be taken when it is being applied to see that it does not get into food. All open containers of food should be removed from buildings being treated. Care must be exercised to see that this poison is not stored with food supplies or anywhere in the kitchen where it might be mistaken for food. It is essential that control measures be made in a regular systematic way at weekly intervals for at least the first month and one or twice a month after control measures have been established.

#### 6. Control of Aedes Mosquitoes.

a. Dengue fever is known to be spread only by mosquitoes of the genus Aedes. Two species, Aedes aegypti and Aedes Albopictus are the known vectors in the Central Pacific Base Command. Both species bite habitually during the day as well as at night. Aedes aegypti is primarily "domestic" in its breeding habits and usually limits its breeding to water in miscellaneous artificial containers, such as cans, bottles, tires, fire buckets; or in man-made situations, such as cisterns, mason or rock walls, etc., within the area. Aedes albopictus may be found in the same breeding places as mentioned above, but in addition is found in water contained in coral holes, tree holes, coconut shells, lily, ape, and banana plants.

b. All mosquitoes require standing water for only ten (10) days in which to pass through the "wiggler" (larval) and "tumbler" (pupal) stages of their life cycle. Hundreds of mosquitoes may be produced in water held by a neglected tin can or coconut shell. Complete control of mosquito breeding in a given area is possible if all standing water is eliminated or treated to kill the "wigglers" each ten (10) days. Oiling with kerosene or No. 2 diesel oil is most effective, and only a very thin film of oil is necessary. Permanent control can be obtained only by systematic inspections, followed by elimination of all breeding places (water containers of all kinds) or treatment of infested standing water with a larvicide.

c. Both Aedes aegypti and Aedes albopictus have a very short flight range. In appearance both are black with silver stripes. When adult Aedes aegypti and Aedes albopictus mosquitoes are discovered it may usually be assumed that their breeding places are

within 100 - 150 yards.

d. All major echelons and separate unit commanders will require that inspections be made to determine presence of mosquito (Aedes) breeding in areas under their control, and that measures be taken to eliminate breeding places where found. Aedes control must be a continuing process. Commanders concerned will be alert to prevent Aedes mosquito breeding in the vicinity of military installations. Liaison with civilians will be made directly or through the Territorial Board of Health.

7. Control of Culex Quinquefasciatus Mosquitoes.

a. Culex quinquefasciatus is a yellow and brown, predominantly night-biting mosquito present in the Central Pacific Base Command. It is the chief nuisance mosquito in the Hawaiian Islands and is a potential vector of filariasis.

b. The Culex quinquefasciatus mosquito has an estimated flight range of several miles. The number of adults in any area is determined by the distance and heaviness of the breeding, the prevailing winds, and the presence of local harborages, such as high grass, depressions in the ground, or other cool, moist places out of the wind. Heavy breeding of this mosquito occurs in polluted standing or slowly running water, such as sewage effluents, shower or kitchen wastes, street catch basins, wastes from piggeries, or in marshy pasture lands which are polluted by the droppings of animals. Breeding is curtailed or controlled by fish, by any rapid, turbulent movement of water, by the dressing of stream banks and clearing of vegetation so as to allow for more rapid movement or for wind turbulence, and by spraying or drip oiling.

c. All possible effort will be directed toward the control of the potentially dangerous and annoying Culex mosquito. All major echelon and separate unit commanders will require that inspections be made to determine the presence of Culex mosquito breeding in areas under their control or in waste waters discharged from their areas. Control measures will be taken to eliminate breeding places whenever practicable. Necessary liaison will be maintained with civilians and other adjacent reservations, either directly or through the



Territorial Board of Health.

BY COMMAND OF MAJOR GENERAL BURGIN:

WAYNE C. SMITH,  
Brigadier General, GSC,  
Chief of Staff

OFFICIAL:

/s/ M. W. Marsh  
M. W. MARSH  
Colonel, GSC,  
AC of S, G-4.

1 Incl: (same inclosure as stipulated on page 90) pages this incl. numbered 91  
Leaflet, "Bedbugs and Their Control" to 94.  
in the Army (attached to Adm O No. 1,  
200.30, 6 Feb 1945.)

DISTRIBUTION: "C" plus AFMIDPAC  
distribution "C" (less 9 & 10)  
Special (50 copies, Surgeon, CPBC)

\*Changed

\*\*Added

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## CHAPTER 29

### Control of Rodents

#### (History of Preventive Medicine)

Interesting historical facts concerning rats and plague in the Hawaiian Islands have been summarized as follows:<sup>1</sup>

1. First case of human plague appeared in the Hawaiian Islands in the Chinese section of Honolulu on December 12, 1899. It is significant that in November of that same year, plague was reported at Kobe, Japan.

2. Maui experienced its initial case in January 1900, and in February 1900, it has spread to Hawaii. It was not until May 1901 that plague was introduced on Kauai.

3. On Oahu cases were reported every year (save 1909) until July 1910 since which time neither human or rodent plague has been identified.

4. Maui had nine (9) human cases in 1900, and then none appeared until 1930. Since then, there had been six (6) cases, four (4) in 1932 and the last in December 1937.

Rodent plague has been observed on Maui since 1931. There have been only thirty-eight (38) cases identified in which the last was on October 31st, 1942.

5. On Hawaii human cases appeared yearly with few exceptions (1901, 1902, 1916, 1931, 1932) until 1935. Since this time only one case had been confirmed on December 23d 1939. Rodent plague has been observed every year without exception since 1907, the greatest number of infected rodents, 129, being observed in 1939. Seventy-nine (79) this year to date.

6. Kauai had four (4) cases in 1901, and nine (9) in 1902. There were two (2) cases in 1906, but none has been observed since. No records of infected rodents were obtained, but in 1936 - 1937 a survey was accomplished to include 8,508 rats, all of which were found to be non-infected. (U. S. Public Health Service recognizes standards

of 5,000 noninfected rats in order to state an area to be free of plague.)

7. No records of human or rodent plague on Molokai, Lanai, Niihau or Kahoolaws.

A very informative pamphlet<sup>2</sup> prepared by the Rat and Mosquito Control Section of Honolulu Chamber of Commerce, states that it costs approximately \$2.00 a year to feed a rat. There are an estimated one hundred thirty million (130,000,000) rats in the United States. In addition, it is estimated that the value of material destroyed or damaged by rats is ten times as great. In other words, it is estimated that the annual costs of maintaining the normal rat population of the United States amounts to the staggering sum of two billion six hundred million dollars (\$2,600,000,000).

In Hawaii, there are four distinct species of rats namely, the Norway or brown rat (*Rattus norvegicus*) the black or house rat (*Rattus alexandrinus*), the gray or roof rat (*Rattus Rattus Rattus*) and the Hawaiian rat (*Rattus hawaiiensis*). The different species of rats have many choices of habitats: fields, burroughs, surface depressions, rock piles, dense brush, trees, and man's own premises.

Control measures listed are as follows:

1. Ratproofing
2. Trapping
3. Poisoning
4. Shooting
5. Gassing
6. Natural enemies

Rats are carriers of some of man's worst diseases, namely: bubonic plague, endemic typhus fever, infectious jaundice, trichinosis, rat bite fever, and amebic and bacillary dysentery as well as eleven species of internal parasites which also occur in man. Some animal diseases transmitted by rats are hog cholera, fowl tuberculosis, swine erysipelas and probably foot and mouth disease.

On 21 April 1942, tentative proposals for rat control were outlined, presumably by the Surgeon, Headquarters Hawaiian Department, in an unsigned memorandum as follows:<sup>3</sup>

The attached copy of an inspection report by the Division Supervisor, Mr. Schultz, raises the question again of the necessity for specific arrangements for a positive system of rat control. The very large number (several thousands) of small buildings, portable type, which will



be required, the necessity for locating them in numerous different places and under very varying conditions, tactical and otherwise, makes it out of the question to adhere closely to the building code which was devised for quiet times and to construction which could be proceeded with at relative leisure. At a conference this date with Colonel Marston, G-4, it was agreed that so far as possible his Department would have buildings placed twenty inches off the ground, particularly in inhabited areas such as the City of Honolulu, that he would return our recommendation with a directive pointing out the necessity for the rat control, following which we are to organize such rat control agency as seems necessary and to develop it as circumstances change.

It is further proposed that we prepare a directive for department publication making organization commanders responsible for keeping a close watch for rats, exterminating them to the greatest extent practicable with the facilities possessed by the organization, having in mind that their primary mission is tactical, and further placing the responsibility on them to report the presence of rats whenever numbers are at all large and their own facilities are inadequate to estimate them.

It is proposed to assign an officer to my office as rat control officer or some equivalent title who will develop a well trained group of enlisted inspectors who can go from place to place to assist in the location of rat harborages. It is further proposed that the actual work of exterminating the rats where it involves labor such as lifting buildings, etc., be largely done by groups of civilian laborers.

It is further contemplated that all Surgeons of the major echelons will be instructed through tactical channels in this matter.

The provisions of this to apply to the entire Department. It may be necessary to have this rat control section as an independent section of the office and not under the Medical Inspector. Decision on this as time passes.

This memorandum may be regarded as the beginning for the military rat control program in the Hawaiian Department.

On 10 May 1942, a letter<sup>4</sup> was issued and signed by the Department Commander, Subject: Rat Control Within Organization Areas. This

publication, the basis of the rat control program in the Hawaiian Islands, is reproduced as follows:

1. a. Rats constitute a major potential health menace in this department. Rats infested with plague have recently been found in certain areas in Hawaii and Maui. Even under normal conditions it is difficult to prevent an undue increase in their numbers. Under present conditions the prevention of such undue increases is possible only by the most unremitting vigilance on the part of every military organization.

b. With the wide dispersion of troops and the necessity for the use of many small prefabricated buildings which often must be set up near or on the ground, numerous ideal harborages for rats are being created.

2. It is directed that:

a. All tent floors and prefabricated buildings be raised high enough from the ground to make inspections possible beneath them.

b. Grass, weeds, rubbish be cleared from the immediate vicinity of all floors and buildings in so far as such action will not interfere with camouflage.

c. Commanding officers of all units will require frequent inspections to determine presence of rats in or about military installations.

d. Eradication of rats and rat harborages will be attempted by all units when found and if unsuccessful, report will be made to this Headquarters stating the nature of the problem.

e. Great care will be exercised in the storing of food so as to make it unavailable for rat consumption.

f. Edible garbage will be kept in tightly covered containers; where possible, edible garbage will be removed. All garbage and rubbish not removed by contract, must be burned or otherwise satisfactorily disposed of daily. Accumulation of refuse will not be allowed to occur.



g. Lumber, boxes, etc. will not be stored under or against buildings and will be raised from the ground so that inspection is possible under and about them.

h. Any existing building, before being occupied by troops, will be closely inspected inside and out for rats, for evidence thereof. Such inspection will include every closed space, such as that between ceilings and roofs.

i. Additional precautions have been prescribed for certain areas on the islands of Maui and Hawaii in separate letters to the Commanding General of respective districts.

This letter was received in the Surgeon's Office on 12 May 1942, and on that date, Colonel Elliott G. Colby, MC, was placed in charge of the Rat Control Program for the Surgeon's Office.

In a letter to members of the Rat and Mosquito Control Committee, Chamber of Commerce of Honolulu, the chairman, inclosed a plan<sup>7</sup> for an intensive rat eradication program. A copy of this proposed program is attached as Inclosure 2.

The meeting of the Rat and Mosquito Control Committee on 6 May 1942 mentioned on the foregoing letter was attended by members of the Territorial Board of Health, one member from the Hawaiian Sugar Planters' Association and two representatives of the Army. The Rat Control Officer made a report<sup>6</sup> of this meeting to the Department Surgeon in a letter, Subject, Rat Control, 7 May 1942, and submitted the following recommendations:

a. That the Army assist in every way in the clean-up campaign on the island of Oahu and that similar campaigns be organized on Hawaii and Maui.

b. That the Army supply trucks and men during the early part of this campaign if the City and County of Honolulu are unable to handle the situation rapidly enough themselves.

c. That enlisted men be trained in rat-trapping and poisoning in order to take over the work in the dock areas on the three islands which are now being done by the Territorial Board of Health.

d. That additional enlisted men be trained in rat-trapping and poisoning so that their services will be

immediately available in case an extensive rat eradication campaign becomes necessary, due to the findings of plague infected rats in any of the harbor areas in the Territory.

e. That a directive be issued by the Commanding General, Headquarters Hawaiian Department, covering measures to be taken immediately by Army personnel for the eradication of rats and rat harborages on Army control areas.

f. That more attention be given to the inspection of shipping between Hilo, Hawaii; Kahului, Maui; and Honolulu, Oahu; in order to prevent possibility of bringing plague, from those areas.

g. That arrangements be made to assist the City and County of Honolulu in securing the shipment of the pump for use at the Kaena Point Dump from San Francisco to Honolulu. It is understood that it has been at the San Francisco dock for a considerable period of time.

h. The USED make available certain material and supplies which may be needed for rat proofing of the more important installations in the Territory of Hawaii.

The following directives<sup>7</sup> were sent to the Commanding General, Maui District and to the Commanding General, Hawaii District in letter, subject, Plague Infected Rats:

a. Raise all temporary housing above the ground so that all areas are open for inspection, and are sufficiently elevated to permit access for cleaning whenever practicable.

b. Allow no refuse, grass, or weeds to accumulate under or about buildings as far as is consistent with camouflage.

c. Cause frequent inspections to be made for rats in and about all buildings and institute measures taken for their destruction. If unable to eradicate rats, this fact will be reported to this Headquarters.

d. Direct all Army personnel report at once to the Plague Laboratory or Board of Health Office, Wailuku, Maui, (Hilo, Hawaii) if dead rats are found in or about Army



installations in the plague infested area. These rats are not to be handled by Army personnel but covered when found until picked-up by the Territorial Board of Health authorities. Secure details from Plague Laboratory of Protection of personnel from dead rodents pending collection by the Laboratory."

On 9 May 1942 the Rat Control Officer submitted a letter to the Department Surgeon, subject, Training in Rat Control. This letter made the following recommendations:

a. That fifteen (15) enlisted men be assigned for a period of ten days to receive rat control training. At least two of these men should be non-commissioned officers.

b. That this proposed training program be conducted by Mr. R. E. Doty of the Hawaiian Sugar Planters' Association.

c. That the training be practical in type with the posts of Ft. Armstrong and adjoining dock area being used for inspection, trapping and poisoning.

d. That the fifteen (15) enlisted men be assigned to Ft. Armstrong on special duty, and housed and fed there during the ten-day period.

e. That one, two and a half-ton truck for the use of these men throughout the ten-day period be provided.

This proposed program was approved by the acting deputy Chief of Staff, on 15 May 1942.

On 26 June 1943, the Surgeon noted in a route slip to G-1, subject, Rat Guards on Cables of Piers, that neglect in the use of rat guards on cables holding ships at piers was widespread and recommended immediate action by proper police authorities to enforce this law. Inspection of tie lines for ships docking at Honolulu Harbor showed that only 50% of the ships were using rat guards on tie lines. Consequently, the Surgeon was directed to write a letter to the Port Commander, by the Adjutant General. This letter which was mailed on 29 June 1942 was addressed to Captain of the Port of Honolulu, and called attention to the neglect of the use of rat guards and requested corrective action. As a result of this letter, steps were taken to furnish each shipmaster with instructions regarding use of rat guards.

On 13 April 1942, the attention of the Surgeon was requested by the Territorial Commissioner of Public Health in a communication concerning the construction of temporary buildings at a level at least twenty inches above the ground in order to prevent rat infestation. This matter involved the Territorial Building Code. The Surgeon urged compliance with the building code and the acting Chief of Staff recommended that the Engineer construct all Theater of Operation buildings with the clear space of twenty inches under the building for purposes of inspection and elimination of rat harborages and that the Surgeon prepare a suitable directive to the Command, directing all Commanders to have frequent inspections for rat infestation and to establish a Rat Inspection Station and Eradication Service from men in his Command.

In order to carry out this program, an appropriation of \$30,000 was made available to the Department Engineer, Hawaiian Department, for Rodent Control Work. Of this amount \$18,000 was made available to ground forces facilities, and \$12,000 for air forces facilities. A letter dated 30 May 1942, subject, Rodent Control Funds, stated "that these allotments have been prepared by a detailed study of the requirements of your Department which has taken into consideration the balance of funds on hand from the fiscal year 1942 funds. Therefore, it should be understood that the funds herein mentioned are to be used for personnel and all equipment and supplies except those which are the technical nature, for example, microscope, and special laboratory apparatus which will be procured from Medical and Hospital Department Funds as required." <sup>8</sup>

Although these funds were assigned to the Engineer, subsequent communication between Engineer and Surgeon, transferred these funds to the Office of the Surgeon. Since appropriation of funds for the rat control program had been approved and allotted, steps were taken to secure necessary poison and traps. In a letter<sup>9</sup> addressed to the Territorial Commissioner of Health, the Surgeon requested recommendations regarding the purchase of poison. In reply<sup>10</sup> the Commissioner recommended the use of Rat Nip or Sence, both of which were phosphorous compounds, and thallium sulfate. He recommended a stock of poison of about 6,000 lbs. and a 100 to 200 lbs. of thallium sulfate. The request by the Surgeon for 12,000 lbs. of phosphorous base rat poison was submitted to G-1; and, also, that 25,000 traps costing approximately 50¢ apiece would be provided. The 12,000 lbs. of phosphorous rat poison was received on the 16th of July 1942. Purchase of rolled oats with thallium sulfate for rodent control, was made on 11 August 1942



and equipment for trapping and prebaiting was also purchased.

In an early report, apparently a weekly report, 1,543 rodents were killed at Fort Ruger and adjacent vicinity. This report<sup>11</sup> was made by the group of enlisted men which had been delegated to carry out the rodent control program under the Rat Control Officer. The Rat Control Program had now been set in motion. Necessary materials and personnel had been supplied and funds had been allotted, a definite program had been outlined, and progress had been initially made in killing rodents. All this had been accomplished in three to four months. A series of reports were made by the rat control section, and in one instance at Schofield Barracks with the use of 255 traps, 11.8 rats were caught daily.

In a memorandum<sup>12</sup> to the Surgeon dated 11 June 1942, subject: Rat Control Program, the Rat Control Officer reviewed the situation regarding personnel and the Rat Control Program. As noted previously in this program, sixteen men were being trained for rat control work, although the responsibility for rat control on Army posts was delegated to the Post Commanders. In paragraph 2 of this memorandum, the Rat Control Officer remarked that "recent survey of posts such as Ft. Shafter and Ft. Armstrong indicates that the rat population is so high that ordinary trapping methods will do no good. Poisoning by the pre-bait system is the only method which at present appears feasible. This must be done by trained men and must be repeated at intervals of two to three months, or possibly oftener." The Rat Control Officer then made the following recommendations:

a. Eight(8) men of the sixteen (16) men including one Sergeant be kept directly under the control of the Department Surgeon's Office. These men would be used on the larger posts and would be held responsible for inspection, poisoning, advice in trapping, rat proofing and clean up campaign of military installations.

b. That the other eight (8) men be returned to their station, and be used by the Surgeon of each of the higher units as inspectors of all stations and Camp sites. These men would do rat eradication work at the smaller installations, but would refer the large problems which they discovered to the men prescribed under (a) above.

c. That the necessary equipment consisting of prebait stations, both poison and unpoisoned oats, be obtained and turned over to the Sergeant in charge of the unit operating

out of the Surgeon's Office. This section would then be responsible for the equipment, and for the rat eradication work on the various larger posts.

d. The section operating out of the Department Surgeon's Office should be given the responsibility of inspection and rat eradication in the harbor area. This is necessary due to the fact that the Territorial Board of Health is unable to operate in the harbor area under present condition.

On 20 April 1942, a member of the Public Health Committee of the Chamber of Commerce of Honolulu, wrote a letter<sup>13</sup> to the Executive to the Military Governor, subject: Control of Rats. In this letter the author spoke of the necessity for rat control, and appended a list of fifteen suggestions, entitled "Householders Program for Rat and Mosquito Control". This list of fifteen points for householders is considered a very practical compilation of measures for rat control, and is given as Inclosure No. 3.

On the 2nd of September 1942, the Surgeon for the Maui Service Command, sent a letter<sup>14</sup> to the Surgeon, Hawaiian Department, Headquarters, Ft. Shafter, subject: Rat Re Plague. This letter called attention to the fact that in the last ten years, six persons had acquired plague in the Maui District, resulting in five deaths, and requested information regarding immunization against plague, and the advisability of immunizing military personnel on the Island of Maui. The first indorsement to this letter is as follows:

Records in this office show that plague rats have been found dead and trapped on Maui from time to time for the past eleven years, with the human cases of plague as noted in basic communication, the last being in 1937. There is no evidence known to this office to show that the situation with regard to plague-infected rats is essentially different on Maui than it has been in the past eleven years. The presence of troops, of course, demands that every precautionary measure be exercised to prevent harborage of rats in and around camps and billets, and contact of troops with rats.

In view of the above it is not believed that a serious threat of exposure to plague exists on Maui, within the meaning of the communication referred to in paragraph No. 1. Therefore, immunization of military personnel on Maui against plague is not considered indicated at this time.



Recommend that measures directed in letter, Headquarters Hawaiian Department, 10th of May 1942, Medical file No. 725.1, subject: Rat Control Within Organization Areas, and Letter Headquarters Hawaiian Department, to Commanding General, Maui District, 8th May 1942, subject: Plague-Infested Rats, be applied diligently.

Plague vaccine is on approved acquisition from this department and will be available at the 5th Medical Supply Depot as soon as it can be furnished from the mainland.

If any unusual circumstances should arise on Maui in regard to this problem this headquarters should be informed promptly.

In a later report to the Department Surgeon from the Surgeon, Maui District, two rats were reported as plague-infested. These rats were trapped on 26 September and 29 September 1942, respectively.

The matter of a suitable rat poison continued to be a problem. In a letter<sup>15</sup> dated 18 September 1942, to the Commanding Officer of the Department Laboratory, the Surgeon for the Maui Service Command, mentioned that the supply of thallium sulfate was very low, and suggested the use of pulverized glass. The Commanding Officer, Department Laboratory, in an indorsement to this letter mentioned that the effect of ground glass was entirely mechanical, and might be rejected by the rats if too large in particle size or be noneffective if too small, and since he had no rats to experiment with, could not determine proper effect of glass. He suggested the use of Red Squill as a rat poison. The letter was referred to the Rat Control Officer who stated that thallium sulfate poisoned rolled oats were still available from the Pacific Guano and Fertilizer Company although the supply was not large. The Rat Control Officer stated that arrangements were being made to procure zinc phosphide as a rat poison which was declared superior to thallium sulfate by the Hawaiian Sugar Planters' Association. The Hawaiian Sugar Planters' Association stated that Red Squill was entirely inadequate for use of the rat poison. In a separate memorandum,<sup>16</sup> subject: Rat Poison, signed by the Rat Control Officer, but undated and without address, it was stated that thallium sulfate was becoming scarce and expensive, costing about \$17.50 a pound.

Paragraph 2 of this memorandum stated:

Experimental work by H.S.P.A. shows that zinc phosphide  $\text{Zn}_3\text{P}_2$  is more toxic than thallium, kills quicker and becomes harmless when left in the field for a few days. This chemical may be procured from the Oldbury Electric Chemical Co.,

22 East 40th St., New York, for approximately \$1.00 a lb. It is prepared by mixing in a ratio of 1-200 with rolled oats. A typical formula would be one twentieth of a pound zinc phosphide, one quart corn oil, twenty pounds rolled oats. The zinc phosphide should be mixed with the corn oil and then with rolled oats shaking it on to the oats out of a can such as a pint myonnaise jar with holes punched on the top. Zinc phosphide is a dangerous poison, and should be handled with care by the person mixing it with the oats. Thirty miligrams of zinc sulphide will kill a rat weighing one kilo, two and two tenths pound, in approximately eight hours.

In a subsequent communication with G-4, subject: Purchase of Rat Poison, dated 27 September 1942, the Rat Control Officer requested the purchase of one eighty-pound can of zinc phosphide for use in rat poisoning, a supply which was considered adequate for six months under normal conditions. This purchase was approved.

In connection with the training of men for rat control work, a rather comprehensive paper<sup>17</sup> on the subject: Rats and their Control, dated 24 September 1942, was compiled by Major Charles B. Perkins, M.C., and is given as Inclosure No. 4. This paper is divided into important subjects such as, General Habits of Rats, Evidence of Infestation, Control Measures, Prebaiting System, Precautions, and Recommendations and Suggestions. A very important part of this paper is contained in paragraph 7, Prebaiting System, which was found to be an effective measure in the control of rats. In Paragraph 7, the detailed instructions day by day for handling prebait system is given, and is considered valuable for general use by all rat control officers.

The report<sup>18</sup> of rat control activities by the rat control section during the period 18 September 1942 to 3 October 1942, was submitted on 3 October 1942, and listed the following measures:

1.	Prebaiting stations placed (unpoisoned)	400.
2.	" " " (poisoned)	212.
3.	Total amount of unpoisoned oats consumed	76.50
4.	Total amount of poisoned oats consumed	13.02
5.	Total number of rats killed by poisoning	1982.
6.	Total number of rats killed by trapping	48.

Recommendations were made in this report concerning elimination of rat harborages. This report was sent as an inclosure to a latter, subject: Rat Control, to the Commanding Officer, Ft. Shafter,



by Command of Lt. General Emmons, directing that recommendations of the report be carried out, and that a similar rat control campaign be carried out on the post within two months.

In a communication<sup>19</sup> to the Surgeon, Hawaiian Department, on 18 September 1942, subject: Treatment of Plague, the Surgeon of the Maui Service Command requested information concerning the use of sulfathiazole in the treatment of plague. The request was forwarded to The Surgeon General's Office, which called attention to Circular Letter No. 56, SGO, 9 June 1941. The following revisions regarding the treatment of plague were noted:

Sulfathiazole by mouth as follows: Initial dose, 4 grams, subsequent doses 1.5 grams every four hours day and night until temperature has been normal for seven days. In fulminating cases sodium sulfathiazole may be tried intravenous route. Subsequent doses 0.03 grams per kilo, five (5) percent colution in sterile distilled water. 0.06 gram per kilo given slowly by the intravenous route. Subsequent doses 0.03 grams per kilo, five (5) per cent solution every six hours. Change to oral dosage as soon as possible. The use of sulfadiazine in man has not yet been recorded, but in mice it is more effective than sulfathiazole and less toxic.

In a report of rat control activity dated 20 October 1942, the following summary<sup>20</sup> of rat control activity on the north shore on the Island of Oahu by the Rat Control Section, during the period of 6 October 1942 to 17 October 1942 inclusive is as follows:

- |   |       |
|---|-------|
| 1. Prebait stations placed (unpoisoned)     | 194.  |
| 2. Prebait stations placed (poisoned)       | 194.  |
| 3. Total amount of unpoisoned oats consumed | 22.   |
| 4. Total amount of poisoned oats consumed   | 12.25 |
| 5. Total number of rats killed by poison    | 1084. |
| 6. Total number of mice killed by poison    | 2024. |
| 7. Total number of rats killed by trapping  | 16.   |

A comprehensive report<sup>21</sup> entitled "Lethal Dose Studies in Cages" was forwarded to the Rat Control Office by the Associate Agriculturist, of the Hawaiian Sugar Planters' Association. These experiments were carried out by the H.S.P.A. to determine the efficiency of various rat poisons compared to thallium sulfate. A chart entitled "Comparative Effectiveness of Some Poisons Expressed in Per cent," gave the following information:

1. Strychnine	10.81 per cent
2. Arsenic	15.2 per cent
3. Ratmort	18.0 per cent
4. L-Tox	18.4 per cent
5. Rat Nip 30%	31.6 per cent
6. Red Squill Powder	40.9 per cent
7. Rat Nip 40%	73.5 per cent
8. Zinc phosphide	96.9 per cent
9. Thallium sulfate	96.6 per cent

An important part of the rat control program consisted of laboratory tests and examinations on suspected rats. The Territorial Board of Health had taken the lead in this matter and had established laboratories on Oahu, Maui, and Hawaii, and with the cooperation of the Army, a laboratory was set up on the Island of Kauai in November 1942. The purpose of the laboratories was to diagnose plague in rats, and the procedures consisted of autopsy, and gross examination of the rats with all suspicious pathological lesions further checked by smears or by guinea pig inoculation, or both. Culture work was not recommended by the Territorial Board of Health as an added precaution against the accidental or even intentional spread of the disease. A culture of the organism is not necessary in the diagnosis of plague. All rats which were found dead or trapped were submitted to the laboratory for examination, and reports were made by the laboratory giving the following information:<sup>22</sup>

1. Identifying number
2. Date
3. Feces
4. Exact location where rodents were found.
5. How obtained, that is, trapped, found dead or killed.
6. Condition when received.
7. Subcutaneous injection.
8. Lymphatic glands, buboes or other lesions.
9. Liver
10. Spleen
11. Pleural effusion
12. Purulent foci
13. Provisional diagnosis of gross lesions
14. Provisional diagnosis from smears

Army personnel were employed in these rat laboratories, and worked in cooperation with the personnel of the Board of Health.

A Headquarters Hawaiian Department letter<sup>23</sup> dated 12 December 1942 subject: Rat Control, directed the establishment of a thorough and



sustained program of rat control by all military organizations, and provided for a training program for personnel in rat control. This letter directed measures for the elimination of rat harborages, for the starvation of rats, for poisoning by the prebait method, for the handling of dead rats, and provided the necessary equipment for trapping and handling rats. As a result of this letter, appointed officers and enlisted men from various posts and camps attended an Army training course in rat control.

The training schedule<sup>24</sup> for the rat control school included lectures, field trips, moving pictures, demonstrations in prebaiting, and other control measures and discussion periods.

Inspection of ship docking in Honolulu showed that of the twenty-one vessels inspected, only two of the ships had the rat guards on all hawsers, and the attention of the Port Commander was again drawn to this matter. This inspection<sup>25</sup> was made on 16 April 1943, and indicated that during the war, there was little success in maintaining rat guards on ships' lines. In May, another inspection of ships in Honolulu Harbor was made to determine the number of rat guards in use. Ten vessels were inspected having sixty-one hawsers. Of this number only fifty-four per cent had adequate rat guards, and there were no ships with adequate rat guards on all of the hawsers. These inspections were continued but a large percentage of ships continued to dock without proper safeguard for rat control.

In a report<sup>26</sup> by the rat laboratory of the Chamber of Commerce, Island of Oahu, the following information was given concerning the number of rats recorded by the laboratory by species.

1. *Rattus alexandrinus* 107 males, 144 females. Total 251
2. *Rattus rattus rattus* 33 males, 70 females. Total 103
3. *Rattus novegicus* 25 males, 52 females. Total 77
4. *Rattus hawaiiensis* 18 males, 13 females. Total 31

Grand total of the rats examined in the laboratory for the month of April 1943 being 462. Examinations of these 462 rats revealed no *Pasteurella Pestis bacilli* found microscopically or macroscopically. In a report from the laboratory for the month of October 1943, a total of 384 rats were examined. No *Pasteurella Pestic bacilli* were found in any of the rats submitted to the laboratory. According to the U. S. Public Health Service, examination of 500 rats without evidence of *Pasteurella Pestis* is indicative of plague-free conditions.

It was noted in a report<sup>27</sup> by the Hawaiian Sugar Planters' Association and the Consolidated Report of Rodent Control of the District Surgeon on Hawaii, that dried coconut is a very effective bait for rats although no one particular bait will trap all rats. It is found to be good practice to vary baits from time to time.

In addition to the conventional methods employed in the eradication of rats on the ground, other means were employed to attack rats nesting in trees. Use of the Chemical Warfare Service flame thrower was tried, but this proved dangerous and not too effective. A better method was the use of shotguns which were almost a hundred percent effective. A Circular, subject: Shooting Rats from Nests in Trees with Shotgun, was subsequently prepared. This circular was later published under the title, Rat Elimination, 3 January 1944, Headquarters U. S. Army Forces, CPA, Circular No. 2.

Other methods of rat control are noteworthy. Biological control has been attempted from time to time in the Hawaiian Islands by the introduction of such animals as owls, dogs, cats, and the mongoose. None of these animals has been particularly successful in eradicating the rats. The mongoose, which is a natural enemy of the rat, is a diurnal animal, and the rat is a nocturnal animal. The mongoose was introduced in the Hawaiian Island in 1883. The only notable effect on the rat population has been the shift in the species ratio of rats present. On the islands not having mongooses, the Norway rat comprises from ninety to ninety-five per cent of the rat population. On islands where the mongoose is present, the Norway rat is found in the smallest number.

Among the chemical methods used for rat control, poison gas, generally hydrocyanic acid, is used in gassing burrows and nests on the ground.

Training in rat control was continued for the duration.<sup>28</sup> Under the direction of the Medical Inspector's Office, Central Pacific Base Command, a course consisting of lectures, and field work in trapping, poisoning, shooting, gassing and inspection was given to various units and divisions.

No new or unusual developments in the rat control program were reported during the latter part of 1944 or until the end of the war.

No epidemics of rat-borne diseases occurred.



## RATS AND PUBLIC HEALTH

The presence of rats in a community is a constant menace to the health of the people. The rat contributes no earthly good but does a lot of harm. Perhaps no other animal on earth lives with less justification. It not only lives and raises its family at the expense of man and other animals, but in its pursuit for the essentials of life, it transmits disease to both man and animal and destroys food, buildings and merchandise.

Rat life persists in a community because of man's indifference and tolerance. There is too much of that "let George do it" attitude. Pardonable this may be during normal times, it is unpatriotic and dangerous to assume this attitude when one's country is at war.

Hawaii has a rat problem. Our equable climate, the practical absence of natural enemies, abundance of natural food and inaccessible harboring places, and a general lack of interest in rat control among the population are some of the chief factors which bring this about. This problem has been complicated by recent concentration of troops and defense workers which constitutes virgin soil for rats to plant their disease germs and the necessity of building up a reserve of food and supplies furnish the rates with additional sources of food.

It is impossible to exterminate a biological species. But rats can be controlled and rendered innocuous if every resident of a community would take cognizance of the danger and initiate proper measures for their suppression. Governmental agencies, civic and health organizations, and volunteers may be able to stem an epidemic but the job of preventing such an epidemic rests with the people. Therefore, solution of the problem lies largely in the interest and cooperation individual citizens take in maintaining a year round rat control program. To insure the success of such a program, it behooves the general public to have a clear understanding of the habits of the rat and to familiarize themselves with the approved methods of rat control.

## REASONS FOR RAT CONTROL

Rats are carriers of some of man's worst diseases, namely: Bubonic plague, endemic typhus fever, infectious jaundice, trichinosis, ratbite fever, and amoebic and bacillary dysentery, as well as eleven species of internal parasites which also occur in man. Some animal diseases transmuted by rats are hog cholera, fowl tuberculosis, swine erysipelas, and probably foot and mouth disease.

No local figures are available showing monetary losses caused by rats, but it must be large, for it is common knowledge that rats:

1. Destroy cultivated grain as seeds, sprouts, or after harvesting.
  2. Destroy merchandise stored and in transit.
  3. Destroy books, leather, harness, gloves and cloth.
  4. Destroy fruits, vegetables, and peanuts.
  5. Kill chickens, turkeys, ducks and pigeons.
  6. Eat enormous quantities of eggs.
  7. Kill wild birds and song birds.
  8. Attack seeds, plants, and flowers.
  9. Damage buildings by gnawing wood, pipes, walls, and foundations.
  10. Kill lambs and pigs.
  11. Have gnawed holes in dams and started floods.
  12. Have started fires by carrying off, and gnawing on, matches and electrical wires.
  13. Have eaten holes in mail sacks and eaten valuable mail.
  14. Have nibbled at the ears, noses and toes of infants in cribs.
- Have attacked and killed man in deserted mines.

According to U. S. Public Health Service figures, it costs approximately \$2.00 a year to feed a rat. There are an estimated 130,000,000 rats in the United States -- one rat to each human population. The annual cost of feeding rats in the United States would therefore amount to \$260,000,000. In addition, the value of material destroyed or damaged by rats is ten times as great. In other words, the annual cost of maintaining the normal rat population of the United States amounts to the staggering sum of \$2,600,000,000:

Before rat poisoning was practiced in Hawaii, an estimated 20 per cent of the sugar crop was destroyed by rats each year. Since the adoption of prebaiting by plantations, this damage has been reduced to less than one per cent.

The pineapple industry has record of damages done to its crops in the fields by rats. The coffee industry suffered annual losses estimated to be \$75,000 for many years.



## SPECIES OF RATS IN HAWAII.

There are four distinct species of rats in Hawaii, namely; the Norway or brown rat; the black or house rat; the gray or roof rat; and the Hawaiian rat.

(From Bureau of Biological Survey Records by H. J. Spencer).

*Rattus norvegicus* (the Norway or common brown rat)

This rat is the largest of the four represented species, attaining a weight averaging 10 to 12 ounces; specimens weighing 16 to 18 oz. are taken frequently. The combined length of the body and head is 8 to 10 inches, and the tail averages an additional 7 to 9 inches in length.

The body of the Norway rat is heavy and rather clumsy; the tail is stout and covered with large, coarse scales like skin. The fur is of a coarse texture, which adds to the general impression of a chunky rough appearance. The rat's ears are small in comparison to the large body and head, and the pads of the soles of the feet are also relatively small. The species has a characteristic number of mammae - 12 in all, 3 pairs located on the chest and 3 toward the groin.

The general color of the fur is so varied that no attempt will be made to describe it. In some specimens the appearance is like that of the gray rat and oftentimes they are mistaken for one another. The characteristics of the species given above are generally used for identification, with no particular consideration for color.

*Rattus rattus rattus* (the black rat)

The black rat is smaller than the Norway rat, its average body length being 5 to 7 inches and the tail measures 6 to 8 inches.

The general appearance of this species is striking. It has not the repulsive aspect of the Norway rat nor does it convey the impression of filth and disease usually connected with the sight of a rat; rather it has the attractive appearance of a squirrel, particularly when seen scampering about in the trees. The contour of the body and head of the black rat is graceful and slender. The head is in proportion with the size of the body, with a sharp muzzle. The tail is slender, and always longer than the combined length of the body and head. The ears and pads of the soles of the feet are relatively large in this species.

The species is characterized by 5 pairs of mammae, 2 on the chest and 3 toward the groin. The fur is of fine, soft texture, ranging in color from smoky gray to jet black.

*Rattus rattus alexandrinus* (the gray rat)

This rat is a sub-species of the black rat. Its physical characteristics is identical with those of the black rat except that its cast of fur is brownish-gray.

*Rattus hawaiiensis* (the Hawaiian rat)

This rat is the smallest of the four species. It is very often mistaken for a mouse or sometimes even reported as an immature gray of Norway rat. The average body weight of this rat is 2 or 3 ounces. Its average body length is 4 to 5 inches and the tail measures an additional 4 to 5 inches. The coloration of the *hawaiiensis* is distinctive of the species. Stone describes him as follows: "Above he is cinnamon brown or russet shading into cinnamon buff on the sides and light buff or buggy white below, strongly mixed with black hairs on the back and sides. Feet nearly white above, and whole underside of the hind feet dark."

A fifth rodent present in the Hawaiian Islands is the mouse (*Mus musculus*) so commonly known that it hardly needs describing. It is the smallest rodent inhabiting Hawaii, seldom exceeding one-third to one-half of an ounce in weight. The general body form is slender. The ears are moderately large, and the tail is about as long as the combined body and head - frequently longer, rarely shorter. The general color is dusky gray above with a darker slate hue towards the middle of the back and ashy gray beneath. This species has five pairs of mammae, 3 on the chest and 2 toward the groin.

#### HABITAT, BURROWS AND NESTS

The different species of rats have many choices of habitats and Hawaii abounds in a variety of natural dwelling places to suit each type of nest - in the fields, in burrows, surface depressions, rock piles, dense brush, and trees, as well as man's own premises.

The Norway rat has, through the ages, been considered to be to a large extent parasitic on man; wherever man dwells, his nest will be found under chicken houses, stock and feed barns, privies, and even in man's own home when conditions permit. That part of the premises most abounding in filth is this rat's natural habitat. In Hawaii, the clemency of nature and the agricultural crops cultivated by man have led the Norway rat to broaden his usual manner of living. He may be found not only around man's dwelling place but also far removed from human habitations,



carrying on a life similar to that of any field rodent. He is, in the Islands, a particular menace to sugar cane, pineapples, and other minor and local agricultural crops.

The Black, and Gray rats nest in trees of nearly all varieties, the tops of shrubbery, dense brush and grassy slopes, rock piles, or in attic or other accessible portions of buildings. The nests are usually constructed of materials typical of the area, grass probably being preeminent. Chicken feathers and the like are used when available. The location of the nest usually indicates considerable forethought as to inaccessibility to enemies and numerous avenues of retreat.

The Hawaiian rat is seldom found in close proximity of buildings and is not known to live other than in burrows. Gulches, grassy slopes, and other waste lands are particularly suited to their methods of livelihood, but the species is found in practically every field locality in which rat abound. Their burrow systems average 3 to 4 feet in length, with generally but 1 or 2 entrances. The depths of the burrow average 12 to 15 inches. Nests are built of masses of loosely woven grass blades, and is on one main line of the burrow system, permitting the rat to retreat from enemies or control measures in either direction of the burrow.

#### GENERAL HABITS OF RATS.

Rats are active at night. They prefer narrow, concealed and out-of-the-way routes which they habitually use. Their repeated travel over such places leaves behind the tell-tale black markings so characteristic of rat runways. These marks are made by the oil and dirt left behind from the rat's fur and are most helpful in tracing rat runs which usually lead from the nest through the opening through which entrance is gained into the building and the location of the food supply.

For a home, rats like a secluded, dark and well-protected place, preferably one in close proximity of an easily accessible food supply. This accounts for their establishment within our houses and buildings where kitchens and pantry insure them an inexhaustible supply of food, while double walls, spaces between floors and ceilings, boxed-in fixtures, etc. furnish them ideal nesting places. These favorable conditions, abundant food supply and protection against adverse weather conditions and natural enemies, are conducive to the breeding of more and larger litters.

Rats can walk along telephone and electric wires with perfect ease and balance. These with vines alongside buildings and overhanging branches are common avenues of approach to buildings. They can jump two feet high, swim half a mile in rough water, dig two feet into the ground, and climb smoothly painted pipes up to three inches in size, any opening larger than one-half inch will admit most rats. Galvanized iron lighter than 18 gauge, lead sheets and pipes, light aluminum sheets, and zinc sheets are no bar to the sharp teeth of the rat.

#### EVIDENCE OF INFESTATION

The signs of rat infestation are those produced by the rats themselves. They are as follows:

1. Droppings
2. Runways.
3. Tracks and tail marks
4. Gnawing.
5. Live rats (actually seen by the inspector)
6. Dead rats
7. Nests.
8. Rat odor.

Droppings.—According to Williams of the U.S.P.H.S., this is the most constant sign of rat infestation and the one on which inspectors most rely. Like that of other rodents, the excreta of the rat is in small firm masses. These are rod-shaped, straight or slightly curved, with rounded ends. In size they vary from 1/4 inch long by 1/16 inch in diameter to 3/4 inch long by 1/4 inch in diameter. Nearly always they are quite dark or black in color. When freshly passed they are soft enough to be squeezed out of shape and often have a glistening, wet appearance. Within two or three days they dry and become hard. Later the surface becomes dull. Very old ones are dust or dirt covered, and may be discolored.

The size, consistency, number, and even the color of droppings may vary considerably with variations of food. Rats under observation have been noted to pass as few as 30 and as many as 180 droppings in 24 hours. In general, grain as food produces relatively few while the more moist foods, and those with much roughage, produce more and often larger droppings.

Rat droppings are passed singly at relatively frequent intervals. Consequently, though they may occur in considerable quantities within small areas, their arrangement is haphazard; they are not seen in small piles or grouped together, as is the case



with some of the other rodents. They will be found wherever the rats roam, which is everywhere, but will be in greater numbers along their runways, near their harborages, and in secluded corners. They will be found in greatest numbers in places seldom cleaned or disturbed.

The size of the various pieces of excreta will determine whether family life is present and litters of young are being reared. It is seen then that it is possible to learn three valuable things through the examination of the excreta found. First, whether the infestation is an old one or one of recent origin. Second, from the quantity and location, the probable extent of the infestation. Third, from the various sizes of excreta, whether families of rats are being reared.

Runways.—All colonizing animals establish runways. These are merely the usually traveled routes from one frequently visited locality to another. The constant passing of many individuals, each leaving a mark, finally produces a well-worn track, obvious to any eye and often giving a great deal of information to the experienced one. The body of the rat is dirty and the hair a trifle oily, so that wherever it rubs against a wall, climbs a pipe or angle iron or swings under an obstruction, it leaves a dark mark. These marks are built up and extended by the constant passage of rats, the runway finally becoming clearly delineated. An experienced observer will detect a runway used by but few rats; runways used by many are plain to the most unobserving, though the unknowing may not realize their significance.

Runways are of the utmost importance to the rat proofer, since they show him where to place a barrier and where the harborage that must be closed or removed is located.

Tracks and Tail Marks.—Like any other animal, rats leave tracks; that is they leave tracks on soft surfaces. The most impressionable surfaces are found in dust collected on surfaces of beams, railings, shelves, pipes, floors, etc. On these the rat leaves a literally tell-tale trail, for the trail of its tail is as characteristic as the marks of the 4-toed paws. In light dust the marks of the toes may be quite clear. On such a surface the dragging tail may also leave an irregular wavy line, though this is not constant and is often a broken track. The rat drags its tail only part of the time, usually only when moving slowly. Rat tracks on the surfaces over hard bases generally show the marks of the separate toes, but tracks in thick dust or bulk grain are usually only regularly spaced little pits or craters. On white-painted

pipes, footprints are very clear and sharp.

Gnawings.-Rats gnaw for three purposes, viz, to cut through an obstruction between one inclosure and another, to cut into a food container (actual or expected), and to eat. The first includes cutting a way into harborages out of spaces in which the rat may be caught, and through partitions or similar barricades. The second comprises cutting into cargo or stores containers. The third includes cutting through the outer shell of some foods as well as their actual eating. Gnawing is always purposeful; it seldom even appears to be at random. In fact, as a rule, it is quite obvious what the rat was trying to accomplish.

Live Rats Seen.-If live rats are seen by the inspector in the course of his inspection, infestation is obvious.

Dead Rats.-Old, dried carcasses of rats are definite signs of past infestation, but do not constitute evidence of present infestation. Bodies of rats which have recently died indicate present infestation, but are not positive evidence. If partly eaten, however, as is often the case, there is little doubt of the present of live rats. Rats partly eaten by cats are badly mangled; those eaten by other rats are more cleanly handled, often the greater part of the viscera having been reached through a single hole through the body wall.

Nests.-In most cases, rat nests are well hidden and located inside of protective harborages. In consequence of such location, nests are not always seen during the course of ordinary inspection. As a rule, they need not be specifically searched out, unless other evidences of rat life are confusing so that the inspector finds it necessary to check against the presence of nests and other signs inside of harborages. In and near the nests are places where one expects to find fresh droppings. The presence only of old droppings about the nests is evidence that the rat infestation has disappeared or that the nest has been abandoned.

Rats' nests may be constructed of almost any soft material, the rat is not at all particular in this respect. It is common to find a much larger collection of material than is necessary for the construction of the nest. In many cases this represents old nests, successively built one on top of the other. In other instances, however, it is a protective and secretive maneuver, the nest being in the center and accessible only through a single narrow opening. Sometimes the nest is simply hollowed out in an already existing collection of soft material, such as a bag of rags, a box of old paper, an old mattress or pillow, etc.



It is sometimes easy and at other times quite difficult to determine whether nests are old or recent. An old nest is generally somewhat out of shape, while a new one is neatly rounded out and pressed on the inside. The age of droppings nearby is a guide, as is sometimes the apparent age of the materials entering into the structure and of remains of food scattered about. Young rats in a nest obviously denote recent construction as well as the presence of parents.

Rat Odor.—The odor of rats is distinctive and characteristic. It is of a must character, but, like all odors, cannot be described accurately enough to be recognized therefrom. Unfortunately, it tends to persist for a considerable period after the rats are gone, so that it cannot be classed as a positive indication of their presence. It is of value, however, as often giving to the inspector information that rats have been present, and thereby intensifying his search for other evidence. Individuals vary considerably as to the acuteness of the sense of smell, and hence, vary in perception of this sign.

#### REPRODUCTIVENESS.

The reproductiveness of rats is limited by food supply and opportunity for nesting and harboring. Well-fed rats living in comfortable, protected nests breed oftener and produce larger litters. Rats reach maturity between 100 to 120 days; the gestation period is 21 days; 5 to 7 litters are produced in a year; and litters vary from 5 to 10 young ones.

Many estimates as to the number of progeny from one pair of rats in a given period have been made. Following are some:

- 1 pair will produce 800 in a year.
- 1 pair will produce 1,000 in a year.
- 1 pair will produce 350,000,000 in three years.
- 1 pair will produce 340,369,959,152 in five years.





## CONTROL MEASURES

Control measures against rats are:

1. Ratproofing.
2. Trapping.
3. Poisoning.
4. Shooting.
5. Gassing.
6. Natural enemies.

From the standpoint of rat control, ratproofing may be defined as the elimination of food and shelter for rats. Put it in another way, it means making food and shelter inaccessible to rats is the essential aim of ratproofing.

The modern trend in rat control is toward ratproofing. Food and shelter are essential to all animals. When the rat is deprived of these essentials it will leave to seek more favorable environments elsewhere. This is precisely what ratproofing aims to accomplish. By denying rats admission to our homes and depriving them of food through proper storage and disposal, they are forced to move away from our homes and buildings. The farther away rats are from the human population the less the chance of contact and thus the danger of contracting rat-borne diseases is minimized. Since fleas are the transmitting agents of plague and typhus fever from rats to human beings, a very important point to keep in mind is that rats under and near buildings carry more fleas than rats away from buildings.

Some common faults found about homes which attract rats or encourage harborage are:

1. Holes in roofs, walls, floors, and around pipes.
2. Open fascia, ventilators, louvers, skylights, flues and chimneys.
3. Overhanging branches and vines.
4. Overhead wires - electric, telephone, and radio.
5. Insufficient clearance under buildings.
6. Improperly constructed basements and cellars.
7. Accumulations of rubbish, rocks, firewood, lumber, tin cans, junk, and odds and ends (in yard, under house, and in attic)
8. Burrows in stone walls, around cesspools, and under concrete or stone floors.
9. Uncovered or improperly covered garbage cans.

10. Exposed feed for poultry and other domestic animals.
11. Faulty storage and disposal of food and feeds.
12. Unprotected trees bearing fruits and edible seeds.
13. Ungathered windfalls.

Ratproofing of buildings consist of (1) the elimination of actual rat harborage, (2) the protection of enclosed spaces that form harborage, and (3) the protection of buildings so that rats cannot invade them.

Harborages fall under three general heads: (1) structural, (2) incidental, and (3) temporary.

Examples of structural harborage and double walls, enclosed spaces between floors, and ceilings, and beneath basement floors, or those that rest flat on the ground. Enclosed stairways, boxed in beams and pipes, improperly constructed loading platforms, and elevator pits are some other common rat harborages.

Incidental harborages apply to those harborages which result from the installation of non-ratproof fixtures, furniture, and equipment which is incidental to the operation of the building and its subdivisions. Such harborage is ordinarily found in boxed-in bases or enclosed spaces in, above, or behind fixtures. Shelves, counters, desks, show-cases, filing cabinets, and plumbing fixtures are frequently found to provide harborage.

Temporary harborage is a type of harborage that generally results from carelessness and general lax sanitation. Such harborage is found in the mass storage of materials or supplies, rubbish heaps, old furniture, odds and ends piled in cellars, attics, and closets, etc. Any such material if left undisturbed for several weeks can and will be used for homes by the rats. From the description of temporary harborage, we can see that this type of harborage is frequently due to negligence and can be eliminated easily. In the cases of stored merchandise and or supplies, generally, a satisfactory schedule for the removal or turnover can be arranged that will prevent harborage.

The most common source of food for rats around homes is the open garbage can. Cans with tight fitting covers should be employed. The garbage then should be collected regularly and disposed of through incineration or burial. Garbage dumps should not be allowed. Food storage in homes should be in ratproof closets or metal containers with tight covers to render it inaccessible to



rats. Food for poultry and other domestic animals should be stored in ratproof storerooms or metal bins. Spillage and unconsumed feed should not be allowed to remain exposed overnight to nourish rats but swept up or collected and disposed of in such a manner that rats cannot reach them. Some trees, like the coconut, date, and algaroba, besides providing nesting places for rats also supply them with food in the form of their fruits. To protect fruit trees and others which bear edible seeds, a band of metal at least ten inches wide should be nailed around the trunks at least three feet from the ground. If windfalls are gathered each evening and kept out of reach of rats, a frequent source of rat food is eliminated. Careless and promiscuous scattering or throwing of uneaten lunches and so forth about school and playgrounds, candies and peanuts in theaters, carcasses of animals and fowls in vacant lots, only help rats to an easy living. Rats are not particular; they eat anything regardless of its state of freshness or decay.

Food stores, restaurants, and food warehouses should pay special attention to the storage of food so rats cannot get it. Slaughterhouses should exercise care in disposing of their wastes beyond the reach of rats.

### TRAPPING

Trapping is a good means of eliminating rats provided a large number of traps are employed. Care is required in the selection of bait and placement of traps. The snap trap is generally accepted as the better type of trap to use. The cage trap is unsatisfactory because rats are too smart and usually shun such a suspicious-looking contraption.

No one single bait will catch all rats. Fruits, nuts, meats, fresh or smoked, fish, dried shrimp, and vegetables offer a variety of baits which may be used. One may either prebait, that is, put several kinds of baits on unset traps to find out which particular bait is taken more freely, then adopting that bait, or he may set his traps with one bait and after he has caught all the rats he can, switch over to another bait, and so on, thus rotating the kinds of bait used. Dried coconut meat has been found to be a very good bait for all localities and conditions.

Traps should be set in the evening to avoid their being accidentally tripped and thus, lose their usefulness. A delicate set is required because the reaction of rats is very fast. Since rats usually follow the wall in moving from one place to another,

traps should be placed about an inch from the wall with the trigger parallel to it. This allows maximum trapping area and permits free approach from either directions. Traps should be properly anchored or staked down, otherwise rats which have not received a fatal blow may drag the traps away with them. To insure maximum efficiency from traps, frequent inspections should be made to keep them clean and moving parts working freely.

Steel traps may be used with or without bait. They should be placed in known runways, along walls, on top of beams, and in the rat's path as he runs out from behind boxes, stoves, and other hiding places.

### POISONING

The use of poison bait while more effective than trapping must be employed with caution. Most rat poisons are toxic to humans and domestic animals. There is also the chance of rats dying in inaccessible places and creating a stench before they are discovered. If one has to use poison, follow strictly instructions on the package, place the bait out of reach of children and animals, and have antidote for the poison handy and within easy reach.

Following are basis for practically all rat poisons:

1. Barium carbonate.
2. Phosphorus.
3. White arsenic.
4. Thallium sulphate.
5. Strychnine.
6. Red Squill.

Prebaiting.—The rat sometimes prefers certain types of foods. It is usually time well spent to pre-bait for several days before the poison is put out — one time a cereal, next time a meat, and then next, trying fruits and vegetables. The bait getting the best reception is the bait that will probably be more effective to use with poison. Unpoisoned bait is placed in containers and exposed for several days until the rats have been accustomed to visiting and feeding at these stations, then poisoned bait is substituted. The rats returning the following evening will unsuspectingly eat a lethal dose.

For a poisoning campaign to be successful, all other sources of rat food must be protected. Food in the kitchen must be



well protected; garbage cans will be covered; and premises thoroughly cleaned of any rat food except the poisoned bait.

### SHOOTING

Rat nests in trees are usually shot down with a shot gun. Shooting within the city limits is prohibited by law and a regular hunting license is required to shoot rats.

### GASSING

Rats in burrows are killed with a poisonous gas. This work should be done by an experienced person or a professional fumigator. Following are common fumigants used:

1. Hydrocyanic acid gas.
2. Calcium cyanide.
3. Carbon bisulphide
4. Carbon monoxide.
5. Sulphur dioxide.
6. Chloropicrin.
7. Methyl bromide

Gassing kills the fleas on the rats and in the nests thus eliminating the transmitting agents of rat-borne diseases.

### Natural Enemies

Natural enemies of the rat are few on these islands. The mongoose was introduced from Jamaica in 1883 to kill off rats by the sugar plantations. It has not met with success because there are still as many rats now as before its importation, the reason being that the mongoose is active during the day while the rat only ventures out at night. The two seldom meet, therefore, the mongoose cannot destroy very many rats. Owls are present here, but they cannot detect or catch rats with such luxuriant vegetation under which to hide and escape. Some cats and dogs are good ratters but they are in the minority. Therefore, too much reliance should not be placed upon them although they are useful to a limited extent in suppressing rats in homes and buildings.

## HANDLING DEAD RATS

Any rat found dead or killed should be sprayed with kerosene before being handled although in the absence of plague, little risk is involved in handling dead rats. They may be buried two feet below ground, burned with other rubbish, or taken to the city incinerator in an ordinary Manila paper sack or paper box.



## Port Regulations

Following are port regulations formulated under international Treaties:

1. If a vessel is from a plague port or if rat life is found on board, the following precautionary measures are required:

- A. Rat guards on all lines
- B. Only one gangway with a watchman.
- C. At night, there must be a light over gangway.

2. If a vessel is from a plague port and over 5 rats are estimated on board, fumigation is mandatory.

3. If a vessel is not from a plague port but over 12 rats are estimated on board, fumigation is mandatory.





CHAMBER OF COMMERCE OF HONOLULU  
HONOLULU, HAWAII, U. S. A.  
April 29, 1942.

To members of Rat and Mosquito Control Committee  
Oahu Health Council  
Public Health Committee  
Chamber of Commerce of Honolulu  
Honolulu, T.H.

Gentlemen:

At the last meeting of the Public Health Committee of the Chamber of Commerce, the question of rat control was brought up. Some of the members of the committee seemed to think that in view of the fact that we are at war, our committee is not doing as much as it might. With this in mind I have asked Mr. Lee to draw up a plan for an intensive rat eradication campaign. This plan is enclosed herewith and will be the principal subject of discussion at our next meeting, May 6, 1942, at 10:30 a. m., at the office of the U. S. Public Health Service, Room 208, Federal Building, Honolulu, T. H.

Very truly yours,

John H. Linson, M. D.  
Chairman, Rat & Mosquito  
Control Committee.

Encl.#2





## OUTLINE OF A RAT ERADICATION CAMPAIGN FOR HONOLULU

- I. Divide city into units.
  1. Four zones of as nearly equal area as possible.
    - A. Subdivide zones into 15 equal districts.
      - a. Each district under one trapper.
        - a. Sets 120 traps daily.
        - a. Sets out poisoned baits.
    - B. Two supervisors to each zone.
    - C. Two trucks and a driver to each zone.
  2. Headquarters.
    - A. Office.
      - a. One director.
        - a. In full charge of campaign.
      - b. Three clerks.
        - b. Segregate reports and compile data.
    - B. Laboratory.
      - a. Four to six laboratory technicians.  
(Depending upon size of rat catch)
        - a. Segregate rats into species and sexes.
        - a. If deem desirable, dissect rats.
- II. Inform public through newspaper, radio, and other channels  
re
  1. Presence of an acute rat problem in city.
  2. Danger connected with existence of such a rat problem. (Rat-borne diseases)
  3. Economic losses to be expected to support a large rat population. (Destruction to property, food, merchandise, and livestock)
  4. Importance of rat control in connection with national defense. (Conservation of health and national resources)
  5. Stress cooperation and total support necessary to success.
- III. Eliminate rat harborages.
  1. All types of hiding and nesting places.
  2. First attack those easily corrected, such as accumulations of rubbish, firewood, old lumber, rocks, bottles, tin cans, junk, odds and ends.
  3. Have free garbage collection for limited time to help eliminate harborages and encourage active participation.
- IV. Cut off food supply.
  1. Install tight covers for swill and garbage cans.
  2. Provide proper storage for food and feed. (Rat-proof storerooms and metal containers)

- V. Eradicate existent rat population.
  - 1. By trapping.
  - 2. By poisoning.
- VI. Rat-proof buildings.
  - 1. Seal up or screen openings in homes and business buildings and otherwise rat-proof property.
- VII. Encourage all year trapping.
  - 1. Possible distribution of traps used in campaign gratis.
- VIII. Establish headquarters for
  - 1. Dissemination of information and advice
  - 2. Enforcement of existing regulations.
  - 3. Conduct of educational program.
  - 4. Check on increase or decrease in rat population through trapping, poisoning, and shooting.



It is pretty well agreed among sanitarians, health officers, and others experienced in rodent control that if permanent results are to be expected, rat-proofing must receive prime consideration and made part of such a program. The principle underlying rat-proofing is that rats, like other animals, must have food and shelter. If these two essentials of life are denied them, they either will have to move out or remain and starve. Rat-proofing does not simply mean the exclusion of rats from buildings of all types, but also includes elimination of hiding and nesting places and cutting off of food supply.

Harborage is necessary for rearing of a family and protection while food is essential for subsistence. Of these two essentials, harborage seems to be the prime factor. All other conditions being equal, it is reasonable to assume that the maximum rat population a given area is able to support is governed by the number of available harborages and the accessible food supply. Therefore, by eliminating all harboring places and rendering food supplies inaccessible, rat life in any locality will be made untenable.

The program to follow is made up of two parts, (1) rat-proofing and (2) reduction of existent rat population.

The city is divided into four equal zones which are in turn subdivided into fifteen districts. Allowing one-third of the city to be composed of inaccessible areas, such as valleys, gulleys, wastelands, and mountain ridges, which estimate is very conservative, there remains 36,096 acres to be covered. Each district will have an area of 601.6 acres. To cover such will require one trapper with 120 traps thirty days. It is desirable to have the campaign completed within a month, if possible, certainly not over two months. This will require 60 trappers, 7,200 traps, 8 supervisors, 8 drivers, and 8 trucks. Since the life of a rat trap is rather short, it will require at least 25,000 traps for the campaign. Covering a district twice will require 60 days or twice the number of trappers, supervisors, drivers, trucks, and traps. One director, three clerks, and from four to six laboratory technicians round up the balance of the personnel.

At the start of the campaign, the public should be informed through newspaper and radio, as well as other channels, regarding:

1. Existence of an acute rat problem.
2. Diseases rats are able to transmit to man and livestock.
3. Damage and destruction to food, merchandise, livestock and property.
4. Importance and bearing upon present defense program.
5. Need of cooperation and total support to insure success.

The first step is to eliminate as many as possible, all existing harborages. It is proposed that harborages requiring minimum effort and little or no material to correct be taken care of first, such as accumulations of rubbish, firewood, old lumber, rocks, junk, bottles, tin cans, and odds and ends which have been found to exist in 42.83% of the premises inspected. People are not apt to make necessary corrections if they involve much work and expense. However, other types of harborages should not be neglected. In this connection, if free garbage disposal service is given for a limited time during the campaign, many harborages would be eliminated and active participation would be stimulated.

In an average home, uncovered or improperly covered swill can constitute the chief source of accessible food for rats. The number of premises guilty of this violation amounted to 49.94% of all premises inspected. The correction of this one condition alone will go a long way in discouraging rat infestation about homes. Proper storage of food and feed in rat-proof storerooms and metal containers should not be overlooked.

After as many as possible of existing harborages are eliminated and principal sources of rat food are protected, men are set out with traps and poison bait to reduce the existent rat population.

The next move is to get householders to rat-proof their homes or put them in condition unattractive to rats. Business buildings should be treated in like manner. Figures show that 19.89% of buildings in residential districts inspected have holes in roof, walls, floors, and around pipes and 21.93% have open fascia, unscreened louvers, ventilators, and skylights through which rats can gain entrance. As a rule most of these defects may be remedied by the owners themselves with a little time and material found at hand. This phase of the work should be emphasized and pushed as the resulting corrections will break the close association between rat and man. Another point to remember is that rats breeding in and under buildings harbor more fleas than those breeding outside and away from buildings.

The last step in the program is to encourage year round trapping among householders. This may be done by giving away traps used for the campaign gratis. There are approximately 40,000 buildings in the city. If each one keeps a trap set, the rat eradication potentiality would be enormous. It would play a tremendous part in keeping the number of rats down.



After the campaign, headquarters should be established where the public can go for information and advice in solving rat problems. A staff of trained inspectors should be maintained to enforce rat control regulations. With a rat-proof city as the ultimate goal, plans for new buildings should be closely scrutinized to eliminate structural conditions capable of affording harbors for rats. Existing old buildings which are beyond repairs and constitute harbors should be condemned and demolished.

In any endeavor involving the public, education is indispensable. The people should be informed of new facts and constantly reminded of the subject to keep them conscious.

Data relative to the increase or decrease in the rat population is important in public work. They serve as a measuring stick in the evaluation of current rat control work and practices and a guide to the planning of future programs.

There is one drawback to any rat eradication campaign except under stress of an epidemic. The public see that work is being done for them and will therefore do nothing toward keeping down the rat population at the reduced low level but sit back and wait for the start of the next public eradication campaign. However, this can be overcome to a large extent by requiring compliance either by strict enforcement of existing regulations or through a military order.





### Householders' Program for Rat and Mosquito Control

1. Garbage cans shall be securely covered. (Loose covers will not do.)
2. Rubbish cans and waste paper boxes shall not contain food stuffs.
3. Food particles shall not be left on streets or other property, unless in covered containers.
4. Attic and basement shall be cleared of all but essential materials.
5. Droppings from fruit trees shall be removed from the ground daily and placed in covered containers.
6. Waste materials shall be disposed of through approved sources with a view to cleanliness and salvage.
7. Overgrowth of grass or weeds will not be tolerated.
8. Vegetable and produce gardeners and private gardeners shall dispose of refuse daily or have refuse placed in covered containers.
9. Broken screens, where materials permit, shall be repaired.
10. Doors and windows to attics and basement, especially outside doors and windows to attic and basement shall be kept closed unless screened.
11. Investigate outer walls of buildings for elimination of holes in building walls and foundation bases by patching, filling, etc.
12. Remove as far as practicable all tree branches overhanging which closely approach the building structure.
13. Attention shall be given to all overhead wiring entering buildings. Metal guards on wires, metal plates fastened to outer walls where wires enter the buildings are recommended.
14. Empty bottles, cans, pails, buckets, etc., on the premises shall be turned bottoms up or hung under cover.
15. Water in outside containers shall be stocked with mosquito fish, rain pools on private property shall be dried up as quickly as possible, moving water shall be kept free of heavy growth. Rain drains on buildings shall be kept clean.

Regular inspection by the household is a requisite.

Incl. 3





HEADQUARTERS HAWAIIAN DEPARTMENT  
Office of the Department Medical Inspector  
Fort Shafter, T. H.

24 September 1942.

RATS AND THEIR CONTROL

1. REASONS FOR RAT CONTROL:

Rats are carriers of some of man's worst diseases, namely: Bubonic plague, endemic typhus fever, infectious jaundice, trichinosis, ratbite fever, and amoebic and bacillary dysentery, as well as eleven species of internal parasites which also occur in man. Some animal diseases transmitted by rats are hog cholera, fowl tuberculosis, swine erysipelas, and probable foot and mouth disease.

No local figures are available showing monetary losses caused by rats, but it must be large, for it is common knowledge that rats:

- (1) Destroy merchandise stored and in transit.
- (2) Kill domestic fowl.
- (3) Destroy fruits and vegetables.
- (4) Damage buildings by gnawing wood, pipes, walls and foundations.

2. HABITAT, BURROWS AND NESTS:

The different species of rats have many choices of habitats - in the fields, in burrows, surface depressions, rock piles, dense brush, and trees, as well as man's own premises.

The Norway rat, has, through the ages, been considered to be to a large extent parasitic on man; wherever man dwells, his nest will be found. That part of the premises most abounding in filth is this rat's natural habitat.

The Black and Gray rats nest in trees of nearly all varieties, the tops of shrubbery, dense brush and grassy slopes or rock piles. The nests are usually constructed of materials typical of the area, grass probably being preeminent. The location of the nest usually indicates considerable forethought as to the inaccessibility to enemies and numerous avenues of retreat.

### 3. GENERAL HABITS OF RATS:

Rats are active at night. They prefer narrow, concealed and out-of-the-way routes which they habitually use. Their repeated travel over such places leaves behind the tell-tale black markings so characteristic of rat runways. These marks are made by the oil and ~~dirt~~ left behind from the rat's fur and are most helpful in tracing rat runs which usually lead from the nest through the opening through which entrance is gained into the building and the location of the food supply.

For a home, rats like a secluded, dark, and well-protected place, preferably one in close proximity to an easily accessible food supply.

Rats can walk along telephone and electric wires with perfect ease and balance. Vines alongside buildings and overhanging branches are common avenues of approach to buildings. They can jump two feet high, swim half a mile in rough water, dig two feet into the ground, and climb smoothly painted pipes up to three inches in size. Any opening larger than one-half inch will admit most rats. Galvanized iron lighter than 18 inch gauge, lead sheets and pipes, light aluminum sheets and zinc sheets are no bar to the sharp teeth of the rat.

### 4. EVIDENCE OF INFESTATION:

The signs of rat infestation are those produced by the rats themselves. They are as follows:

- (1) Droppings.
- (2) Runways.
- (3) Tracks and tail marks.
- (4) Gnawing.
- (5) Live rats (actually seen by the inspector).
- (6) Dead rats.
- (7) Nests.
- (8) Rat odor.

Droppings - are the most usual sign of rat infestation and the one on which inspectors most rely. They are nearly always quite dark or black in color. When freshly passed they are soft enough to be squeezed out of shape and often have a glistening, wet appearance. Within two or three days they dry and become hard. Later the surface becomes dull. Very old ones are dust or dirt covered, and may be discolored.



Runways - All colonizing animals establish runways. These are merely the usually traveled routes from one frequently visited locality to another. The constant passing of many individuals, each leaving a mark, finally produces a well-worn track obvious to any eye and often giving a great deal of information to the experienced one. The body of the rat is dirty and the hair a trifle oily, so that wherever it rubs against a wall, climbs a pipe or angle iron or swings under an obstruction, it leaves a dark mark. These marks are built up and extended by the constant passage of rats, the runway finally becoming clearly delineated. An experienced observer will detect a runway used by but few rats; runways used by many are plain to the most unobserving, though the unknowing may not realize their significance. Runways are of the utmost importance to the rat proofer, since they show him where to place a barrier and where the harborage that must be closed or removed is located.

Tracks and tail marks - Like any other animal, rats leave tracks; that is, they leave tracks on soft surfaces. The most impressionable surfaces are found in the dust collected on surfaces of beams, railings, shelves, pipes, floors, etc. On these the rat leaves a literally tell-tale trail, for the trail of its tail is as characteristic as the marks of the 4-toed paws. In light dust the marks of the toes may be quite clear. On such a surface the dragging tail may also leave an irregular wavy line, though this is not constant and is often a broken track. The rat drags its tail only part of the time, usually only when moving slowly. Rat tracks on impressionable surfaces generally show the marks of the separate toes, but tracks in thick dust or bulk grain are usually only regularly spaced little pits or craters. On white-painted pipes, foot-prints are very clear and sharp.

Gnawing - Rats gnaw for three purposes, viz. to cut through an obstruction between one inclosure and another, to cut into a food container (actual or expected) and to eat. Gnawing is always purposeful; it seldom even appears to be at random. In fact, as a rule, it is quite obvious what the rat was trying to accomplish.

Nests - In most cases, rat nests are well hidden and located inside of protective harborages. In consequence of such location, nests are not always seen during the course of an ordinary inspection.

Rat's nests may be constructed of almost any soft material--the rat is not at all particular in this respect.

It is common to find a much larger collection of material than is necessary for construction of the nest. In many cases this represents old nests successively built one on top of the other. In other instances, however, it is a protective and secretive maneuver, the nest being in the center and accessible only through a single narrow opening. Sometimes the nest is simply hollowed out in an already existing collection of soft material, such as a bag of rags, a box of old paper, an old mattress or pillow.

Rat odor - The odor of rats is distinctive and characteristic. It is of a musty character, but, like all odors, cannot be described accurately enough to be recognized therefrom. Unfortunately, it tends to persist for a considerable period after the rats are gone, so that it cannot be classed as a positive indication of their presence. It is of value, however, as often giving to the inspector information that rats have been present, and thereby intensifying his search for other evidence. Individuals vary considerably as to the acuteness of the sense of smell, and hence, vary in perception of this sign.

#### 5. REPRODUCTIVENESS:

The reproductiveness of rats is limited by food supply and opportunity for nesting and harboring. Well-fed rats living in comfortable, protected nests breed oftener and produce larger litters. Rats reach maturity between 100 to 120 days; the gestation period is 21 days; 5 to 7 litters are produced in a year; and litters vary from 5 to 10 young ones.

#### 6. CONTROL MEASURES:

Control measures against rats are:

- (1) Rat proofing.
- (2) Trapping.
- (3) Poisoning.
- (4) Shooting.
- (5) Gassing.
- (6) Natural enemies.

From the standpoint of rat control, rat proofing may be defined as the elimination of food and shelter for rats. The modern trend in rat control is toward rat proofing. Food and shelter are essential to all animals. When the rat is deprived of these essentials it will leave to seek more favorable environment elsewhere. This is precisely what rat proofing aims to



accomplish. The farther away rats are from the human population the less the chance of contact and thus the danger of contracting rat-borne diseases is minimized. Since fleas are the transmitting agents of plague and typhus fever from rats to human beings, a very important point to keep in mind is that rats under and near buildings carry more fleas than rats away from buildings.

**Trapping** - Trapping is a good means of eliminating rats provided a large number of traps are employed. Care is required in the selection of bait and placement of traps. The snap trap is generally accented as the better type of traps to use. The cage trap is unsatisfactory because rats are too smart and usually shun such a suspicious looking contraption.

No one single bait will catch all rats. A few of the better baits are bacon rind, fruits, vegetables, fish and candy. Dried coconut meat has been found to be a very good bait for all localities and conditions. The best method to follow in trapping is to use one type of bait until you catch all the rats you can and then switch to another type of bait, and so on, thus rotating the kinds of baits used.

Traps should be set in the evening to avoid their being accidentally tripped and thus losing their usefulness. Since rats usually follow the wall in moving from one place to another, traps should be placed about an inch from the wall with the trigger parallel to it. This allows maximum trapping area and permits free approach from either direction. Traps should be properly anchored or otherwise rats which have not received a fatal blow may drag the traps away with them. To insure maximum efficiency from the traps, frequent inspections should be made to keep them clean and moving parts working freely.

**Poisoning** - The use of poison bait while more effective than trapping must be employed with caution. Most rat poisons are toxic to humans and domestic animals.

The poison found to be the most successful in and around the army camps on the Island of Oahu was THALLIUM SULPHATE treated oats.

#### 7. PREBAITING SYSTEM:

1st Day - Place 1/4 lb. (about one cupful) of clean, unpoisoned rolled oats at each station. Number each station and keep a record of its location, treatment, etc.





4th Day - Inspect all stations. Refill the pans with fresh, unpoisoned oats if they are empty or much of the oats has been eaten, or soiled by rats. Any soiled oats removed must be put in a bucket and not dumped near the station or left lying around. Nothing but clean oats must be left.

6th Day - Remove all of the oats, clean the pans and clean up any oats the rats may have spilled around the pans. Then place one cupful of clean, poisoned oats in the pans. Also keep a record of the amount of unpoisoned oats taken by the rats at each station.

9th Day - Inspect all stations. Weigh or estimate the amount of poisoned oats left in each pan, which will indicate how much has been eaten and roughly tell how many rats have been poisoned.

NOTE: One pound of thallium treated oats at a concentration of 1-200 is sufficient to kill about 150 good sized rats. Three grams of this oat mixture will kill one rat. (453.60 grams = 1 lb.)

453.60 = 151

3

#### 8. PRECAUTIONS:

- a. Don't handle the poison.
- b. Keep poison supplies locked up.
- c. Keep the oats dry. Rats won't eat oats that smell mouldy.
- d. Don't touch dead rats without rubber gloves.

#### 9. RECOMMENDATIONS AND SUGGESTIONS:

- a. 100 ft. between prebait stations.
- b. One man can take care of approximately 100 prebait stations.
- c. A notice should be placed in the daily bulletin stating that no extra policing will be done during the period of rodent control.
- d. Camp or territory to be worked should be divided into equal sections. Each section should be inspected by the man assigned for possible rat harbors.

CHARLES B. PERKINS,  
Major, M. C.

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## CHAPTER 30

### Immunization

#### (History of Preventive Medicine)

The status of immunizations on 7 December 1941 was as follows:

1. When war reached the Hawaiian Department on 7 December 1941, the immunizations which had already been required for all military personnel in the Department were smallpox, typhoid-paratyphoid fevers, tetanus and yellow fever.
2. Smallpox and typhoid-paratyphoid immunizations were required for all troops by AR 40-215.
3. Immediate Action Letter, WD, Adjutant General's Office, AG 720.3 (1-10-41) M-A-M, subject: Vaccination of troops against yellow fever, dated 30 January 1941, had been received by the Commanding General, Hawaiian Department, to the effect that all military personnel now stationed in the tropical regions of the Western Hemisphere, including Panama and Puerto Rico would be vaccinated against yellow fever. It was not clear whether this requirement referred to the Hawaiian Department. Inquiry was made to the War Department by letter dated 18 February 1941.<sup>2</sup> The War Department replied by radio, dated 29 March 1941,<sup>3</sup> that "it is not intended that troops in Hawaiian Department be vaccinated against yellow fever at this time" but that it was desirable that vaccine be stocked in the Hawaiian Department. In May, 1941, Immediate Action letter, War Department, Adjutant General's Office, AG 720.3 (4-17-41) M-WPD-M, subject: Vaccination of Troops against Yellow Fever, dated 9 May 1941,<sup>4</sup> was received by the Commanding General, Hawaiian Department, to the effect that all military personnel and civilian Army employees stationed in tropical regions, including Bermuda would be vaccinated for yellow fever. It was not clear whether this requirement referred to the Hawaiian Department, and inquiry was made by radio, dated 7 June 1941.<sup>5</sup> Radio reply from the War Department, dated 10 June 1941,<sup>6</sup> stated that "troops in

Hawaiian Department are required to be vaccinated against yellow fever." In compliance with the radio directive, vaccination of all troops for yellow fever was directed by letter to all subordinate commanders, dated 16 August 1941.<sup>7</sup> During the interval between June and August, 1941, the necessary yellow fever vaccine was requisitioned and received from the mainland. A test group of 110 men were immunized against yellow fever at Schofield Barracks in July, 1941, under the supervision of a board of medical officers. Experience gained in the immunization of this test group was used in preparing instructions contained in the letter directive of 16 August. No civilians were vaccinated against yellow fever.

4. Immunization of all Hawaiian Department troops against tetanus during the period 1 June - 1 August 1941 was required by War Department radio to Commanding General, Hawaiian Department, dated 11 April 1941.<sup>8</sup> These immunizations were directed in the Hawaiian Department by a letter to subordinate commanders, dated 8 May 1941.<sup>9</sup> A number of urticarial reactions to tetanus immunization were experienced at first, and it was directed that adrenalin be ready when tetanus immunizations were being given. Records of tetanus immunizations and stimulating doses were embossed on identification tags. Tetanus immunizations were offered to civilian Army employees on a voluntary basis. To insure that all military personnel in the Hawaiian Department had completed required immunizations against smallpox, triple typhoid, tetanus, and yellow fever, the Commanding General, on 5 December 1941, directed that an immediate recheck be made by an officer of the Medical Corps of all service records of soldiers and immunization records of officers of the command.<sup>10</sup> Reports received from the various echelons after 7 December 1941 showed some deficiencies, all of which were corrected.

Authority for the voluntary immunization without charge to civilian Army employees against smallpox and typhoid-paratyphoid fever was requested by letter to The Adjutant General, dated 30 September 1941.<sup>11</sup> Approval was given by the War Department in a radio dated 21 October 1941.<sup>12</sup> Smallpox and typhoid-paratyphoid fever immunizations were given to all civilian Army employees who were



willing to accept them.

Compulsory Smallpox and Typhoid-Paratyphoid Fever Immunizations for Military Personnel and Civilian Army Employees was undertaken in December, 1941: In compliance with paragraph 1b (4), AR 40-215, dated 4 March 1940. The Commanding General, Hawaiian Department, directed that all military personnel and civilian Army employees be immunized or re-immunized against smallpox and typhoid-paratyphoid fevers, except those satisfactorily immunized within the twelve previous months.<sup>13 14</sup>

Compulsory Smallpox and Typhoid-Paratyphoid Fever Immunizations for all Civilians in the Territory was undertaken beginning in February, 1942: There began a program of compulsory immunization against smallpox and typhoid-paratyphoid fevers of all civilians in the Territory of Hawaii, by order of the Commanding General, Hawaiian Department, the Military Governor of the Territory. This subject is more fully covered under Chapter 40 of this history, subject: Civil Public Health. By the end of the year 1942, it was estimated that approximately 90% of the civilian population of the Territory of Hawaii had been vaccinated against smallpox and typhoid-paratyphoid fevers.

Yellow fever vaccination hepatitis occurred in large numbers of military personnel arriving on transports from the U. S. mainland in early March, 1942. Additional cases developed among these newly arrived personnel in the Hawaiian Islands. The disease closely simulated infectious hepatitis (catarrhal jaundice) and, therefore, was considered to be contagious. By 23 April 1942, a total of 1136 cases had already been reported.<sup>15</sup> With the large number of military cases there was considerable alarm that the disease would become widespread among the military personnel and civilians of the Territory. Strict epidemiological control was exercised, insofar as knowledge of the disease existed at the time. Arrangements were made in advance for the inspection of incoming personnel as they disembarked from transports.<sup>16</sup> Newly arrived troops were placed in working quarantine, and physical inspections were made as often as twice daily to detect and isolate early cases of jaundice. Particular attention was given to the detection of cases among food handlers, as the disease was assumed to be transmissible through the gastro-intestinal tract. All recognized cases were hospitalized and screened by mosquito bars or otherwise from mosquitoes, flies, and other insects.<sup>17</sup> Immediate action was taken to set up special temporary hospitals apart from the established hospitals; first to provide for the large number of hepatitis cases apart from other patients, and second, to

clear established hospitals for possible battle casualties.<sup>18</sup> The Territory was under imminent danger of Japanese attack. Between 1 March and 1 August 1942, there occurred 4465 cases of hepatitis with a peak of 1857 cases during the month of March. The hepatitis rate for the Hawaiian Department during the year 1942 was 45.1, compared with rates for 1943 and 1944 of 0.5 and 0.3 respectively.

#### Hepatitis Cases by Months - Hawaiian Department, 1942

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January.....	0
February.....	0
March.....	288
April.....	1857
May.....	933
June.....	821
July.....	563
August.....	77
September.....	37
October.....	25
November.....	13
December.....	10
Total	<u>4624</u>

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At the request of The Surgeon General investigation was made of the lot numbers of the yellow fever vaccine previously received by these hepatitis cases on the mainland. In 551 cases where the lot number could be quickly determined, results were as follows:<sup>19</sup>

<u>Lot No.</u>	<u>Cases</u>
335 .....	216
331 .....	284
367 .....	12
334 .....	8
340 .....	12
219 .....	7
330 .....	3
350 .....	2
338 .....	3
329 .....	1
336 .....	1
322 .....	1
321 .....	1



The above information was transmitted to The Surgeon General within a few hours by radio. "Questionnaires for use in connection with cases of jaundice without known cause," received from The Surgeon General, were reproduced in number, completed and returned.

In compliance with War Department radio, dated 18 April 1942, all stocks of yellow fever vaccine supplied by the laboratory of the International Health Division of the Rockefeller Foundation with the Hawaiian Department were destroyed.

Yellow fever vaccination for military personnel in the Hawaiian Department was revoked by immediate action letter, War Department, Adjutant General's Office, AG 720.3 (6-22-42) M3-SPGA-PS-M, subject: Vaccination of troops against yellow fever, dated 29 June 1942, and by letter, Office of The Surgeon General, subject: Vaccination against yellow fever, dated 29 June 1942.<sup>20</sup>

A single stimulating dose, one cc of tetanus toxoid, to be given one year after the completion of the initial immunization, was directed for all military personnel of the Hawaiian Department by letter, dated 3 June 1942.<sup>21</sup>

A second complete series of typhoid-paratyphoid fever immunizations was required for all military personnel in the Hawaiian Department who had received only one previous series. This was directed by letter, dated 5 July 1942.<sup>22</sup> The second series was directed to be given one year after the initial series. This policy had the approval of The Surgeon General. The practice of the utilization of a yearly intradermal injection of 1/10 cc triple typhoid vaccine for the maintenance of immunity to the typhoid-paratyphoid fevers was not approved.<sup>23</sup>

A review of copies of the "Questionnaire for use in connection with cases of jaundice without known cause" showed numerous deficiencies in the recording of yellow fever vaccine lot numbers within the command. A letter directing correction of these deficiencies was sent to all subordinate commanders, dated 14 August 1942.<sup>24</sup> Inspections of immunization registers and service records of various units in January, 1943, showed that deficiencies in the completion of immunization records were numerous and widespread throughout the command. Circular No. 14, Hq Hawaiian Department, 23 January 1943,<sup>25</sup> was published directing that commanding officers institute a thorough check of immunization records and take necessary steps to correct existing errors, omissions, and discrepancies.

The number of employees of the United States Engineers Office on Oahu in early 1943 was approximately 17,000. By order of the District Engineer this large body of civilian Army employees was immunized against tetanus and reimmunized against smallpox and typhoid-paratyphoid fevers during 1943.<sup>26</sup> A small number of employees had been previously immunized against tetanus. These individuals were given a stimulating dose one year after the initial series.

Vaccination of military personnel of USAFICPA against yellow fever had been discontinued since 1942, at which time yellow fever vaccination had been directed by the War Department to be reserved for military personnel stationed in or passing through yellow fever endemic areas. In October, 1943, the Commanding General, USAFICPA, directed that all military personnel under his command be vaccinated against yellow fever, except for those previously so vaccinated.<sup>27</sup> This was done upon the recommendation of the Assistant Secretary of War, as a counter-measure against the possible introduction of yellow fever into the Territory as an offensive weapon by the enemy.<sup>28-33</sup> The civilian population was not vaccinated, but 600,000 doses of yellow fever vaccine were requisitioned and stored on Oahu for a rapid immunization of all civilians in case of emergency. The Commanding General, USAFICPA, was assured by the Assistant Secretary of War that yellow fever vaccine now produced by the Army had no icterogenic properties. To test the potency of the yellow fever vaccine used on military personnel 97 specimens of blood were drawn from personnel one month after vaccination and submitted to the Rockefeller Foundation for determination of protective antibodies.

Annual revaccination of all military personnel and civilian Army employees subject to field service with the Army by means of a single stimulating dose of 0.5 cc of triple typhoid vaccine administered subcutaneously was directed by Section I, Circular No. 143, Hq USAFICPA, dated 9 October 1943.<sup>34</sup> This directive was published in compliance with Changes No. 6, paragraph 10c(2), AR 40-210, dated 30 August 1943.

After several years in which no human cases of plague occurred in the Territory 11 fatal cases of human plague occurred in the Hamakua District of Hawaii between March, 1943 and April, 1944. Immunizations were made available to the civilian population of the District on a voluntary basis in April, 1944, and approximately 85% of the population was immunized. Following the immunization program only 2 cases of human plague occurred, both fatal. One occurred in a nonimmunized person. The other case occurred in an immunized individual 14 months after immunization. This case



survived for over a month of illness, dying of peritonitis following internal rupture of a bubo. At autopsy no plague bacilli could be recovered. Stimulating doses of plague vaccine were made available in July, 1945, and the percentage of immunized population was brought up to approximately 90%. No military camps have been located in the Hamakua District. The other plague endemic area in the Hawaiian Islands, the Makawao District of the Island of Maui, has contained numerous military personnel, however, no human plague has been reported from Maui since 1937, and very few rodent plague cases have been found. No immunizations for plague have been given to military personnel for reason of duty in the Hawaiian Islands, and no military cases of plague have occurred. In the Makawao District of Maui a vigorous rat control program was carried out, both by the Army and the Territorial Board of Health with the assistance of the U. S. Public Health Service.

In order to eliminate the necessity for sending individual immunization instructions to each unit alerted for overseas movement within and from the Central Pacific Area, prior to operations in the Gilbert Islands, standing immunization requirements were published in HQ USAFICPA, Standing Procedure for Overseas Movement of Troops within and from the Central Pacific Area.<sup>35</sup> This publication, short title: "CPA-POM" was revised and kept as nearly up-to-date as possible for the period of the war. After 1 July 1944, this publication became "CPBC-POM" of the Central Pacific Base Command. Immunization requirements for overseas movement of troops within and from the Central Pacific Area and Central Pacific Base Command were considered to be the same as for troops proceeding overseas from the U. S. mainland. On this basis, a repeat smallpox vaccination was required if the individual had not been so vaccinated during the preceding nine months, and a stimulating dose of tetanus toxoid was required unless there had been prior immunization within six months. The smallpox revaccination requirement was maintained until early 1945, when at the direction of Headquarters USAFPOA, smallpox was required only once every three years regardless of movement forward. The requirement of an additional tetanus immunization on movement forward was discontinued on revision of CPBC-POM dated 29 January 1945, on the basis of TB MED 114, subject: Immunization, dated 9 November 1944.

Beginning in January 1944, typhus immunization was required for all personnel in attack and garrison forces taking part in the establishment or occupation of new advanced bases in the Central Pacific Area. This immunization was required because of the uncertainty of medical intelligence concerning the prevalence of typhus fever in the Japanese Mandated Islands, and particularly

because of the large number of troops involved in these operations on small land mass areas.<sup>36</sup> It was understood that there was very little evidence that the standard Army typhus vaccine available gave protection against endemic or mite-borne typhus. This requirement for routine typhus immunization of all personnel of attack and garrison forces was maintained until February, 1945, when instructions concerning typhus immunization were again made on individual unit movement orders. Typhus vaccination was never thought necessary for troops on duty in the Hawaiian Islands, Fanning, Christmas, Canton, and the Gilbert Islands.

In accordance with War Department radiogram No. WX-31833, dated 4 May 1944, a Headquarters USAFICPA directive was published to subordinate commanders 17 May 1944, to the effect that yellow fever vaccination will be considered adequate if administered not more than 4 years and not less than 10 days prior to entry into or passing through an endemic area.<sup>37</sup>

All prisoners of war held within the Central Pacific Base Command were required to be immunized against smallpox, typhoid-paratyphoid fevers, and tetanus, with reimmunizations, according to the same dosages and schedules as required for AUS personnel. Smallpox and typhoid-paratyphoid immunizations were required under provisions of Article 13, Geneva Convention of 1929, and for the protection of the command. Tetanus immunization was indicated as a protective measure for the individual and to simplify treatment in case of injury.

Vaccination against yellow fever was revoked For all military personnel in Pacific Ocean Areas by Section V, Circular No. 91, Headquarters USAFPOA, dated 12 June 1945. It was directed by the Commanding General, USAFPOA, that 500,000 doses yellow fever vaccine be maintained in storage in the Central Pacific Base Command.<sup>38</sup>

In secret letter, AG 720.3 (11-14-44) OB-S-E-SPMOT-M20, subject: Immunization for troops moving overseas, dated 20 November 1944, the War Department required immunization of all troops moving to Pacific Ocean Areas for typhus, cholera, and plague. Prior to 20 November, these immunizations had not been required for troops of the Central Pacific Base Command. Furthermore, there was no indication for them. Officers and enlisted men returning to the Central Pacific Base Command from rest and recuperation leaves and furloughs were held up at Ports of Embarkation to complete these immunizations. Immediate action was taken to correct this situation.<sup>39</sup> The requirements were revoked in late January.<sup>40</sup>



To date no case of human or animal rabies has been known in the Hawaiian Islands. Territory of Hawaii quarantine laws prohibited the introduction of dogs and cats into the Territory without a period of quarantine. The provisions of Change No. 2, paragraph 30, AR 55-485, dated 7 January 1944, prohibiting the carrying of pets or mascots on U. S. Army transports or at War Department expense gave additional insurance that rabies would not be introduced to the Territory. Strong command attention was given to quarantine requirements and responsibilities. However, with the large numbers of Army, Navy, and Marine Corps personnel staging in and passing through the Territory, there could be no assurance that rabies-infected animals were not being introduced. For this reason, it was directed that in all cases of animal bite where the animal could not be identified and properly observed, the patient receive the Pasteur treatment for rabies as promptly as possible. The necessary vaccine for this purpose was procured and stored.

Beginning in June, 1945, a brief mild epidemic of Influenza B occurred among the civilian population of Honolulu, and to a less extent on outlying islands. Relatively few military personnel became infected. As a precautionary measure certain Medical Department personnel in epidemiological, administrative, and supply work, and those in contact with patients were immunized with Army influenza vaccine. The benefit of this immunization could not be determined, as the outbreak quickly subsided. Immunizations were accomplished 26 June 1945.

To eliminate confusion as much as possible, and to keep all elements of the Central Pacific Base Command informed concerning the frequently changing immunization requirements of the Central Pacific Base Command and higher headquarters, directives summarizing immunization requirements were published and revised as necessary. Two series of directives resulted, a series of revisions to Headquarters CPBC, Standing Procedure for Overseas Movement of Troops within and from the Central Pacific Base Command, <sup>41-44</sup> and a series of currently up-to-date annexes to Headquarters CPBC Administrative Order No. 1 (Index CPYSG 204.80) subject: Immunization. <sup>45-47</sup>

Benefits of the Immunization Program were as follows: <sup>48</sup>

1. Smallpox: No civilian or military cases occurred within the Hawaiian Department, Central Pacific Area, or Central Pacific Base Command during the duration of the war. (During the years 1932-1945 there have been 4 civilian cases of smallpox, 3 in 1938 and 1 in 1940).

2. Typhoid Fever: No case occurred among military personnel. The typhoid immunization program for civilians took place throughout the year 1942. Following this immunization program civilian typhoid fever cases were markedly reduced, as shown in the table below. Of the 121 cases reported in 1942, over 70 cases occurred in an outbreak from a Honolulu public school cafeteria before the immunization program was begun.

Civilian Typhoid Fever Cases  
Territory of Hawaii

1940 .....	56 cases
1941 .....	69 cases
1942 .....	121 cases
1943 .....	9 cases
1944 .....	5 cases
1945 .....	7 cases

3. Tetanus: No military cases occurred throughout the war. There was no program for the immunization of civilians for tetanus. The incidence of tetanus among civilians during the years 1940-1944 was as follows:

Civilian Cases of Tetanus  
Territory of Hawaii

<u>Date</u>	<u>No. of Cases</u>	<u>No. of Deaths</u>
1940 .....	25 .....	Not available
1941 .....	23 .....	Not available
1942 .....	30 .....	8
1943 .....	17 .....	7
1944 .....	18 .....	6
1945 .....	15 .....	10

4. Yellow Fever: There was no known exposure to yellow fever. There was no known introduction of a yellow fever patient nor of infected mosquitoes. Yellow fever immunizations were given upon the recommendation of the Assistant Secretary of War as a protective measure against the possible use of yellow fever as an offensive weapon by the enemy.



5. Typhus Fever: There was no known exposure to the virus of epidemic typhus fever. Typhus immunizations were given only to individuals of attack and garrison forces staging to take part in the establishment of new Central Pacific bases. A number of cases of endemic typhus fever occurred among military personnel who had been vaccinated against typhus fever. In general, it appeared that these cases were milder. Often more than 6 months had elapsed between typhus immunization and illness.
6. Plague: Among military personnel immunizations were given only to individuals of certain units scheduled for operations in certain forward Pacific areas, and to a few enlisted Medical Department technicians working for the Territorial Board of Health in plague control laboratories. No cases of plague have occurred among military personnel.
7. Cholera: There was no known exposure of military personnel to cholera. Immunizations were given only to individuals of certain units scheduled for operations in certain forward Pacific areas. No cases of cholera have occurred among military personnel.

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## CHAPTER 31

### Intestinal Infections

#### (History of Preventive Medicine)

During the year 1941, there were no serious epidemics in the Hawaiian Department; however, there were several outbreaks of food poisoning and dysentery which were quickly brought under control.<sup>1</sup>

Bacillary dysentery is endemic in the Territory of Hawaii, and sporadic cases have appeared from time to time. The following outbreaks of bacillary dysentery, all of the Flexner type, occurred among military personnel during 1942:<sup>2</sup>

1. 40 cases in one battery on the island of Hawaii.
2. 140 cases in one company and its associated personnel on Oahu.
3. 400 cases in the Army task force stationed at Canton Island.

In addition to the 400 cases diagnosed by stool culture at Canton Island, 225 other individuals at the station had symptoms of dysentery during the course of the outbreak, but positive stool cultures were not obtained. For the most part this was believed due to the fact that adequate laboratory facilities were not available at the station at the onset of the outbreak so that many cases had time to recover and become free of the organisms before stool cultures could be made. In each instance of a dysentery outbreak, recognized control measures were applied and the response to these was gratifying.<sup>2</sup>

Occupation of Baker Island in 1943 was accompanied by an outbreak similar to that which occurred in 1942 when a garrison was established on the coral atoll at Canton. Experience indicated that dysentery, which was endemic in the Central Pacific Area, might be expected whenever a coral island was occupied unless adequate sanitary control measures were immediately taken. It was often difficult to build fly proof latrines because of the sandy nature of the terrain. On Canton Island this problem was solved by construction of impervious concrete pits which were emptied by means of portable cesspool pumps. The contents of the pit were then emptied into the sea in areas where there was an offshore

current. Epidemics were invariably due to a combination of a Carrier in the command, faulty latrine construction, and the presence of large numbers of flies.

Control of epidemics was brought about by stool examinations (by the rectal swab technique) of all members of the command; elimination of carriers by treating all positive cases with sulfaguanidine; and effective fly control.<sup>3</sup> When outbreaks of bacillary dysentery occurred, field bacteriological teams were sent to the spot to perform rectal swab cultures on all personnel in affected units for the identification, isolation, and treatment of carriers.<sup>4</sup>

It was the policy in the Central Pacific to assume all cases of diarrhea to be bacillary dysentery until proved otherwise, and all diarrheas were hospitalized for study and treatment. Outbreaks tended to occur only under field or combat conditions. For the control of bacillary dysentery emphasis was placed upon the indoctrination of troops in the necessity for individual discipline in the sanitary disposal of fecal wastes and garbage for the control of flies. The use of sodium arsenite was developed for the control of fly breeding under combat conditions, in latrines, shattered enemy ration dumps, and dead on the battle field. The importance of food-borne infection was recognized.<sup>4</sup> Use of DDT and paradichlorobenzene in fly control is discussed in another chapter.

An outbreak of Salmonella Newport infection occurred in a company of military police following the ingestion of roast turkey, dressing and gravy on Christmas day 1944. The Christmas dinner had been prepared over field ranges and investigation showed that several hours elapsed between the time of preparation of some portions of the dinner and the time of ingestion. There were a total of fifty-three cases from a company strength of approximately 140. Of these cases positive stools were found in eighteen (18). The organism was identified as Salmonella Newport, group C; VI, VIII, e, h - 1, 2, 3. Four asymptomatic carriers of Salmonella Newport were also discovered in the organization; three of these were mess personnel and included the Mess Sergeant. This was the first outbreak of dysentery due to Salmonella Newport in this area.<sup>5</sup>

Cases of amebic dysentery consisted mostly of asymptomatic carriers. A number of these were found through a survey of the personnel of two field hospitals which returned from Saipan for rest and recuperation in 1944. It is doubtful that very many cases or carriers of amebic dysentery had the origin of their infection within the geographical limits of the Central Pacific Base Command.<sup>4</sup> Carriers were also discovered among troops who arrived in the Central



Pacific from Puerto Rico in the summer of 1945.<sup>6</sup>

During the early months of 1945, there were approximately thirty patients transferred to hospitals of the Central Pacific Base Command with the diagnosis of schistosomiasis. These patients had been stationed on the Island of Leyte in the Philippines. Most of them had been attached to an Engineer Battalion and an Infantry Division, where constant exposure to fresh water ponds and streams was unavoidable. Repeated examinations of the stools were necessary before a positive diagnosis could be made in many cases. Special sedimentation techniques for the concentration of *Schistosoma japonicum* ova proved helpful in making the diagnosis. A persistent eosinophilia was frequently the only positive finding until numerous stool examinations proved the presence of *schistosoma* ova.<sup>7</sup>

Sporadic cases of acute infectious hepatitis occurred within the geographical limits of the command. A number of these cases occurred among troops recently arrived from the continental United States. A total of 337 Army and Marine cases of hepatitis were evacuated from Saipan to Central Pacific Base Command hospitals during 1944. All of these Saipan cases were mild and no fatalities occurred.<sup>4</sup> During late 1944 and early 1945 cases of hepatitis were hospitalized from other forward Pacific areas such as the Philippines and Ryukyus. Cases of local origin were never present in sufficient numbers to be of serious consequence.

In 1942, over 4500 cases of jaundice occurred following yellow fever vaccination. These were classified in the Hawaiian Department as acute infectious hepatitis and were included as communicable diseases on the Form No. 86 ab report. However, in view of later findings concerning the etiology of this type of jaundice, these cases should not be considered infectious hepatitis and should not be included as communicable diseases.<sup>2</sup>

Approximately, 4000 prisoners of war from Okinawa arrived on Oahu after June, 1945. The group was examined for blood and stool parasites. Examinations of stools proceeded slowly and was not completed at the time of the cessation of hostilities. In August, 1945, 739 (89%) of 832 stools examined were positive for one or more parasites. Hookworm was the most common helminth found; others included *Strongyloides*, *Ascaris*, and *Trichocephalus*. Among the protozoa found in the group were *Endameba histolytica*, *Endameba coli*, and *Endolimax nana*.<sup>6</sup>

# Intestinal Disease

Rates per Thousand Per Annum<sup>8</sup>

	1942	1943	1944	1945
Common Diarrhea	10.99	8.32	16.65	12.78
Dysentery, bacillary and carriers	3.61	3.14	2.43	2.06
Dysentery, amebic	0.07	0.08	0.44	3.10
Bacterial Food Poisoning	*	*	0.87	3.76
Dysentery, unclassified	0.55	0.22	0.10	0.10
Paratyphoid fever	0.03	----	0.01	----
Typhoid fever	----	----	0.01	----
Hepatitis infectious	45.10	0.55	0.54	2.33
Schistosomiasis	0.01	----	----	0.54
Hookworm	*	*	0.04	1.07

\* Not a reportable disease



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## CHAPTER 32

### Infections of the Respiratory Tract and Infections Transmitted by Discharge from the Respiratory Tract

#### (History of Preventive Medicine)

Common respiratory diseases were the leading communicable diseases in the Central Pacific both before and during the war. Rates for the respiratory diseases and diseases transmitted by discharges from the respiratory tract are shown in Table I, below.<sup>1</sup>

TABLE 1-Respiratory Diseases

Diseases	1942	1943	1944	1945
Common Respiratory Diseases	83.45	74.92	58.34	121.35
Pneumonia, primary atypical	3.63	4.36	3.40	8.04
Influenza	3.65	0.95	2.84	3.62
Pneumonia, primary	3.29	1.82	0.89	1.14
Mumps	1.62	1.82	1.18	3.64
Measles	0.66	0.09	0.40	3.76
Measles, German	1.42	0.82	0.40	2.30
Tuberculosis	0.62	0.76	0.65	1.91
Streptococcus Sore Throat	0.01	----	0.93	2.41
Chickenpox	0.07	0.14	0.04	0.92

The rates shown above for the first eight months of 1945 were probably not true rates, but were very nearly double the actual figure. With the breakdown of the Central Pacific Area on 1 August 1944, and the establishment of the Central Pacific Base Command and Pacific Ocean Area Headquarters on Oahu, strength figures were based on the assignment of units to one or the other echelon. However, all hospitals on the island of Oahu were Central Pacific Base Command hospitals, and no discrimination was made between the hospitalization of patients assigned to CPBC or POA. The following are some of the factors which contributed to give falsely high admission rates for CPBC. First, there were almost as many troops assigned to POA (later known as Army Forces Mid-Pacific) within CPBC geographical confines as there were CPBC troops. The POA troops included the Air Force units, troops assigned to the IX Corps, the Tenth Army, and

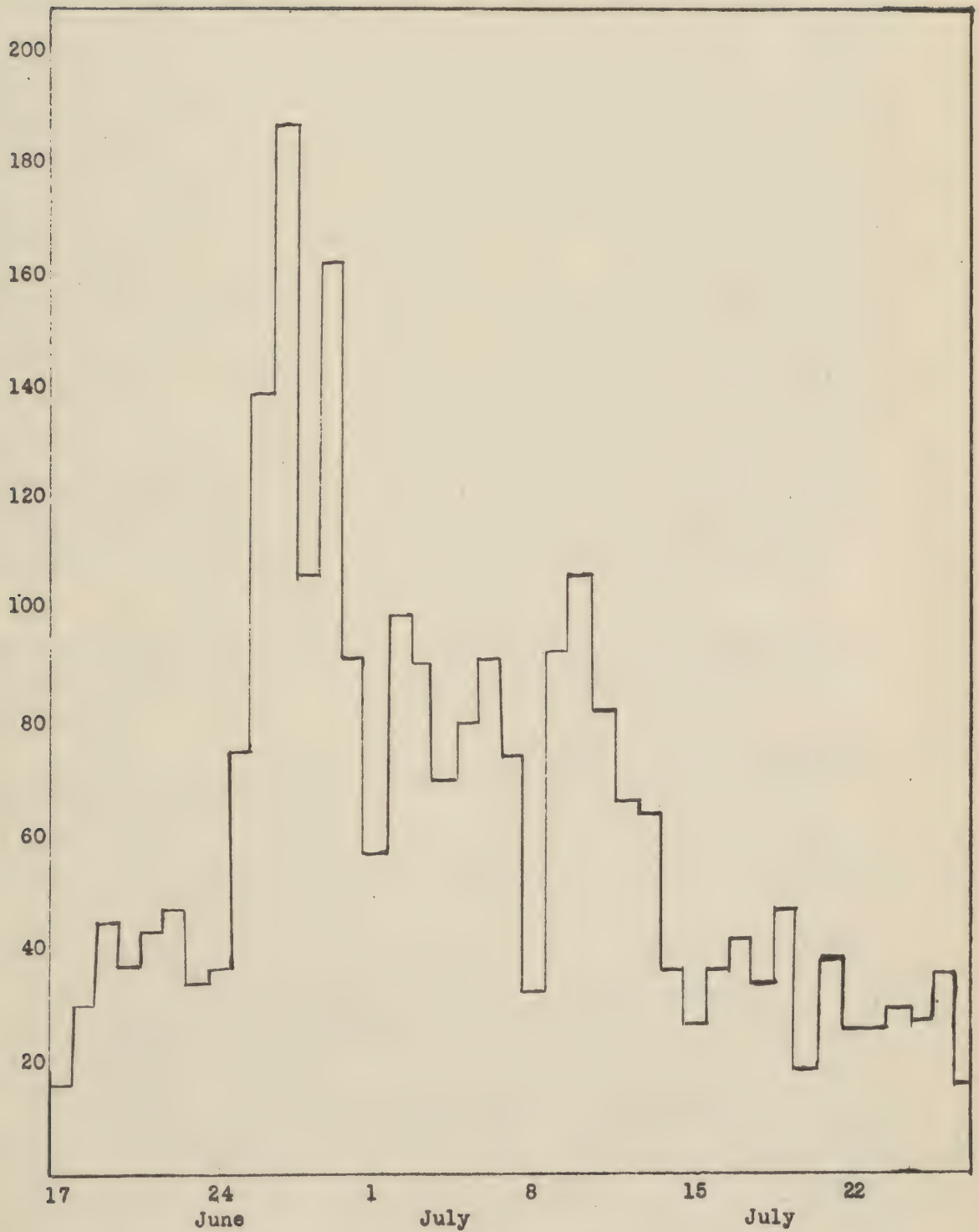
other replacements staging in the Hawaiian Islands but not assigned to the Central Pacific Base Command. Such troops were admitted directly to CPBC hospitals, and their admissions were totalled with the admissions of CPBC troops. However, when the total admissions were divided by the figure of the CPBC strength, a hospital admission rate approximately double the true rate was the result. In many instances troops evacuated from forward areas to CPBC hospitals as admissions by transfer, were found to have or to be carriers of communicable diseases, such as hookworm, malaria, bacillary or amebic dysentery during their hospital stay or subsequent to discharge to units within the Central Pacific Base Command. Such communicable diseases were charged against CPBC rates. Troops admitted to CPBC hospitals from transports arriving from the mainland or from forward areas were charged as direct admissions to CPBC hospitals, and contributed to the CPBC rates. Communicable diseases developing within the Command within the normal incubation period of arrival from other areas belonged in this category.

In June 1943 a sudden increase in the incidence of respiratory infections was noted in the civilian population on Oahu. This was followed shortly by a slight increase of the same disease among military personnel. The epidemic consisted chiefly of nasopharyngitis but occasional cases were diagnosed as influenza. (The same disease was considered influenza among civilians). All cases responded to symptomatic treatment and were returned to duty in a few days. The annual admission rates for upper respiratory infections per thousand per annum, for military personnel in this area for the month of June, July, and August were 92, 95, and 82 respectively. This disease ceased to be a problem by the first of September when the incidence returned to normal. The mean monthly rate for the rest of the year was 75 per thousand per annum.<sup>3</sup>

Influenza was not ordinarily a reportable disease in the Territory of Hawaii. Because of an apparent increase in the incidence of respiratory disease clinically diagnosed as influenza, the President of the Territorial Board of Health required the disease to be reported as of 16 June 1945. Forty-eight cases had been reported to the civilian population of Honolulu within 48 hours after the disease became reportable. Arrangements were made by the Surgeon of the Central Pacific Base Command with civilian authorities to obtain blood specimens and throat washings from civilian cases diagnosed as influenza.<sup>4</sup> Laboratory studies carried out at the 18th Medical General Laboratory indicated that the disease occurring among civilians was influenza B.<sup>2</sup> This was determined by examining acute and convalescent blood specimens for the presence of antibodies against influenza type A and B. The same laboratory also isolated influenza B virus from throat washings of a civilian patient.<sup>2</sup> When



**INFLUENZA**  
**Admissions to CPSC Hospitals**  
**From 17 June thru 27 July 1945**







it became apparent that influenza B was occurring, a directive was published by Headquarters USAFPOA,<sup>5</sup> requiring hospitalization of any patient with respiratory disease and reduction of contacts by allowing a minimum of 75 square feet of floor space per person. Following the publication of this directive, there was an immediate and marked increase in the number of hospital admissions for respiratory diseases. (See chart on following page). The number of civilian cases reported as influenza declined the first week of July 1945, and the directive mentioned above was rescinded 9 July 1945.<sup>6</sup> Following that time, the number of military admissions for respiratory disease decreased. It was not possible to state the exact number of actual influenza cases in military personnel. Only forty-five cases were reported as influenza during a five-week period ending 29 June 1945. Many cases were reported as "nasopharyngitis", "upper respiratory infection", or "fever of unknown origin". Medical officers were reluctant to diagnose "influenza" without a serologic basis for diagnosis, and it was not convenient or practicable to carry out laboratory tests to confirm such a diagnosis on all patients which were hospitalized as "flu" suspects. The disease was mild in most cases and known complications were not a prominent feature of this epidemic. Clinically, the pneumonia observed during this epidemic resembled the atypical variety, and it was believed that the pneumonia was coincidental and not secondary to influenza.

The introduction of captured prisoners of war to the Hawaiian Islands was cause for concern in preventing communicable diseases. Stool surveys, mass roentgen examinations of the chest, and blood examinations were carried out whenever indicated.

A chest survey by means of 4 x 5 inch single photofluorographic film was conducted on Italian prisoners of war during the months of April and May 1945.

A total number of 1980 subjects were examined by this survey. Findings in the survey were as follows:

Essentially negative.....	1,921
(Including completely calcified and sharply defined fibrotic lesions of minimal extent)	
Pulmonary tuberculosis.....	30
Non-tuberculous pulmonary disease.....	6
Pleural changes.....	9
Cardiac contour variations suggesting pathologic changes.....	11
Rib anomalies.....	3
TOTAL	<hr/> 1,980

The thirty prisoners diagnosed roentgenologically as having pulmonary tuberculosis were hospitalized for further study to determine the extent of activity.<sup>4</sup>



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## CHAPTER 33

### Venereal Diseases

#### (History of Preventive Medicine)

The venereal disease rate fell from 14.1 cases per thousand per annum in 1941 to 3.79 cases per thousand per annum for the first eight months of 1945, (Chart I). Venereal disease was never a major problem in the Hawaiian Islands, but the rate fell to an all time low during the period of the war. The factors responsible for the extremely low Hawaiian Department rate were not all known, but some of them included interest in the diseases since 1860; a clinic in operation since 1921; regulation of prostitution; a moderate control program since 1937; the insular nature of the area; a polyglot population, many of whom lived in slums; disparity in numbers between men and women, importation of large numbers of single male laborers, first for plantations then for war work; a high social breakdown rate, and later a large population increase at the outset of the war. While all of these factors may not directly relate to the presence or absence of venereal disease, many of them normally reflect scenes in which venereal disease is quite prominent. Following the outbreak of war and the establishment of martial law in the islands, the normal conditions of life changed sharply. A curfew and blackout became effective. Prohibition was instituted and was absolute for several months, following which moderate relaxation occurred. Many women were evacuated from the Territory while men were imported for the Services or war work. The entire civilian population was registered and finger printed, and travel between outlying islands and the Mainland was placed under absolute control. The number of white prostitutes declined and recruitments of new operations became difficult.<sup>1</sup>

During the first five months of the year 1942, the venereal disease control activities of the Hawaiian Department followed the ordinary policies which had existed in the past. These included education regarding prevention and control of venereal disease, monthly physical inspections to detect the presence of venereal disease and the reporting of cases to the military police who attempted to pick up infected women and send them to private physicians for treatment.

On 21 May 1942, the Office of the Military Governor, Honolulu, T. H., issued General Order No. 107, Section I of which, outlined the control of communicable disease in the Territory of Hawaii, and applied particularly to the control of venereal disease.<sup>2</sup> Close cooperation between the Army, Navy, and the Territorial Board of Health was achieved

in the enforcement of the provisions of this General Order. A medical officer was appointed venereal disease control officer for the Department to coordinate the activities of the three services.

Venereal disease control activities following the issuance of General Order No. 107 were as follows:

Reporting by special messenger to the Territorial Board of Health of all contacts were made within 24 hours after diagnosis of the disease. The Territorial Board of Health energetically followed up all of these contact reports and as a result a large number of infected women and men were quickly placed under treatment.

An intensive drive was carried out by both military and civilian police in the pick-up and examinations of all street walkers to determine whether or not they were diseased. All recalcitrant patients who did not take adequate treatment, and infected prostitutes who had not been reported by their private physicians or those still infected after having been pronounced cured by their private physicians, and street walkers were hospitalized under military control.

An effective educational program was carried out throughout the entire Command with the use of training films as well as films supplied by the Territorial Board of Health, the distribution of educational literature, and monthly lectures to all Commands stressing the importance of prophylaxis.

Venereal disease control activities were carried on under General Order No. 107, Office of the Military Governor, until 10 March 1943, when there was a return of many activities to civilian authorities.<sup>3</sup> Control of communicable disease was one of the functions returned to the Territorial Board of Health. Prior to 10 March 1943, the regulations of the Territorial Board of Health, especially those pertaining to the control of venereal disease, were rewritten and made law by order of the Governor of the Territory.<sup>4</sup> These new regulations were as effective in operation as was the operation of General Order No. 107. They were adequately enforced by civilian authorities. Close cooperation continued to exist between the venereal disease control officers of the Army, the Navy, and the Territorial Board of Health. Principal activities carried out by the armed forces in venereal disease control during the year 1943, were as follows:<sup>5</sup>

Hospitalization of all acute venereal disease cases among the armed forces until they were considered noninfectious.

Adequate contact reporting by Medical Officers assigned to venereal disease treatment in all Army hospitals. These reports were



# VENEREAL DISEASE

Rates per thousand per annum

HAWAIIAN DEPARTMENT, 1936 THROUGH AUG. 1943

CENTRAL PACIFIC AREA, SEPT. 1943 THROUGH JULY 1944

CENTRAL PACIFIC BASE COMMAND, AUGUST 1944 THROUGH AUGUST 1945

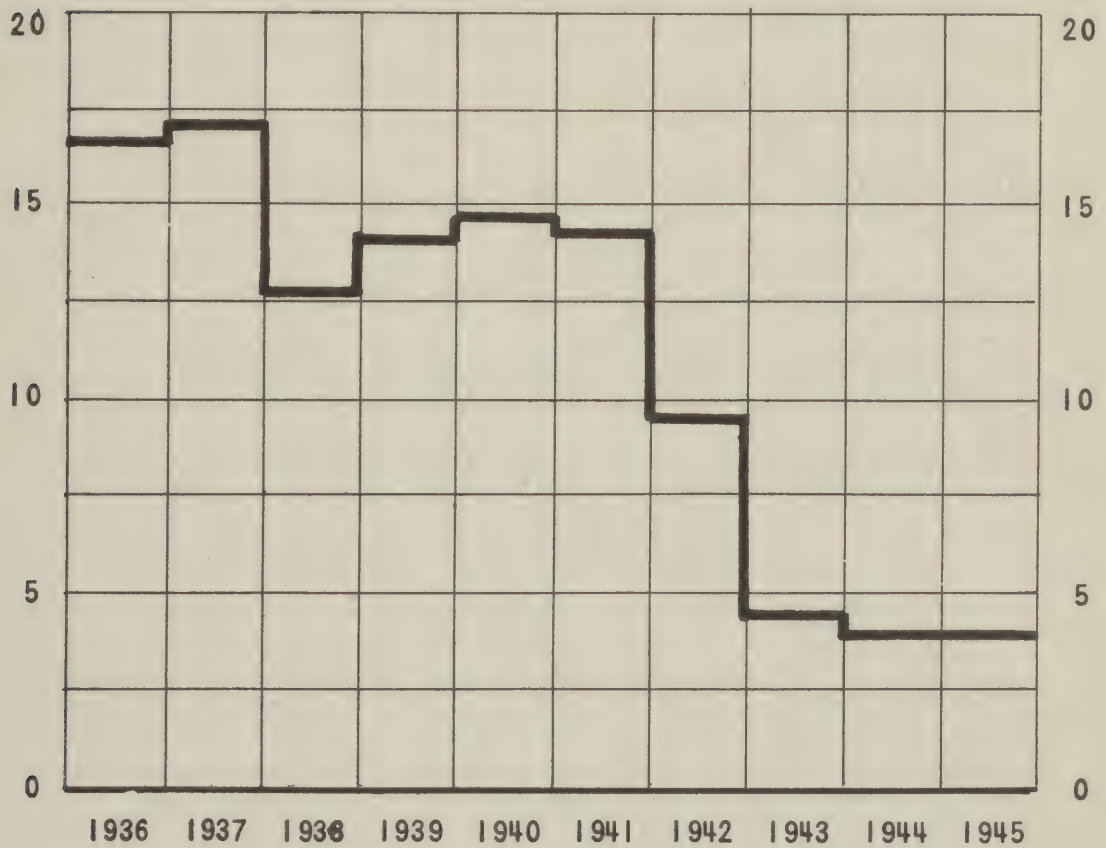


CHART I





sent by special messenger to the venereal disease section of the Territorial Board of Health within 24 hours after diagnosis was made. The Territorial Board of Health with the aid of well-trained personnel promptly located named suspects. When the persons were located, they were examined at the venereal disease clinic of the Territorial Board of Health, and if found infected, all cases were hospitalized until cured, with the exception of a very few individuals whom it was felt could be trusted to carry out ambulatory treatment.

The picking-up of questionable women at bars, dance halls, and similar places of amusement was continued by civilian and military police. Women so detained were sent to the venereal disease clinic of the Territorial Board of Health for examination.

An extensive prophylaxis program was placed in operation. Four large prophylactic stations, were operated in downtown Honolulu by the Army. One was operated by the U. S. Navy. Data available indicated that an increase in the prophylactic rate was an actual increase in the number of prophylactics taken per exposure.

An educational program was actively continued. Training films of the U. S. Public Health Service were in constant use. Two posters on the subject of prophylaxis, giving the address of stations and other information, were prepared and 5,000 of each were posted throughout the Command. Locations of all prophylactic stations were shown on passes. A large variety of venereal disease publications from the U. S. Public Health Service were kept in all prophylactic stations and approximately 500 of these publications were taken by men each month. A pamphlet on gonorrhea was prepared and 60,000 copies distributed to the Command as well as over 100,000 U. S. Public Health Service pamphlets on venereal disease control. The supply of literature and printing of pamphlets and posters was made possible through cooperation with the venereal disease control section of the Territorial Board of Health who provided the necessary funds.

At the onset of the coordinated program, diagnostic and treatment facilities<sup>1</sup> were amply provided for servicemen in the several Army and Navy Hospitals. The facilities for civilians consisted of a moderately interested but extremely busy group of medical practitioners; a small number of whom were interested in the problem; a score of "house doctors" responsible for the medical care and examination of prostitutes in the city, most of whom were conscientious, careful, qualified practitioners, others of whom were indifferent or incompetent to diagnose contagious venereal disease; government physicians in thirty-six districts of the Territory who were responsible for the care of communicable disease and

the indigent sick; and the Board of Health Clinics. In the city of Honolulu, the Board of Health Palama Clinic was adequately equipped to handle the diagnostic and treatment loads in the area, as were the Board of Health clinics in Hilo, Hawaii, and Wailuku, Maui.<sup>1</sup>

Treatment was accomplished in accordance with current War Department directives, but the policy of treating gonorrhea on a duty status as indicated in TB MED 96 published in September, 1944, was not followed in the Central Pacific Base Command until July, 1945. The venereal disease rate had always been so extremely low that such treatment seemed unnecessary. For example, the total rate for locally contracted cases of all venereal diseases for the month of March, 1945, was 0.25 cases per thousand per annum. With such a low rate, it was obvious that venereal disease did not contribute very much to the noneffective rate. Therefore, it seemed preferable to continue to treat gonorrhea in hospitals rather than to risk the exposure of contacts to cases of venereal disease which might be infectious. Furthermore, with only twenty-six cases of gonorrhea in a two month period there was no strain placed on hospital bed facilities.<sup>6</sup> However, following publication of Section III, Circular No. 3, Medical Treatment of Gonorrhea, Headquarters, USAFMIDPAC, 9 July 1945<sup>7</sup>, the duty status treatment of gonorrhea was instituted. All cases of new gonorrhea were treated by hospitals as outpatients except those in whom an accurate diagnosis could not be made immediately. Such cases were hospitalized until the diagnosis was made. Treatment consisted of 200,000 units of penicillin given intramuscularly in four 50,000 unit doses spaced two hours apart.

It was recognized at the outset of this program that certain infected promiscuous individuals had to be removed from the community if they were to be kept from exposing others. General Orders 107 provided the services of Army Provisional Hospital #3 for hospitalization<sup>1</sup> of patients deemed necessary by the health department. This provision of hospital facilities for civilians was an indubitable aid in the reduction of disease rates.<sup>1</sup>

Early in July, 1942, the first patient was admitted to any army section of the hospital. At that time known professional prostitutes who had their own private physicians were not hospitalized as it was the feeling in the community that professional prostitutes could be handled adequately as outpatients, as had been done in the past. In September 1942, it became apparent that professional as well as clandestine prostitutes needed to be hospitalized. The "house physicians" were asked to hospitalize their infected clients at any private hospital in the city, but following hospitalization



their patients were to be examined by the Board of Health Palama Clinic prior to "going back on the floor." There was a sudden influx of infected professional prostitutes into private hospitals. This large influx of an undesirable type of patient into already overcrowded hospitals made it imperative that other bed facilities be found, following which arrangements were made for private wards adjacent to Army wards in the Kuakini Hospital. These wards were opened 4 January 1945.<sup>1</sup>

During the year, sixty-three patients were admitted to the Army Provisional Wards and fifty-three to the private wards of the hospital. The exact number of professional prostitutes hospitalized prior to January, 1943, is not known but was probably in the neighborhood of forty.<sup>1</sup>

Prostitution<sup>1</sup> flourished in Hawaii with little or no regulation until 1929. Between 1929, and the time of the war, prostitution continued to exist on a somewhat smaller scale than was common to many mainland communities. New operators were difficult to obtain and with the great influx of men, the average time of each exposure was reduced 3-6 minutes. Some of the bordellos were of the parlor type, others were merely cribs in which the landlord or madam rented rooms to the girls on a daily basis; most of these were located in the slums.<sup>1</sup>

Early in 1942, a study was made by the health department of sources of new venereal infection reported by service men, over seventy-five per cent of which came from regulated, inspected houses of prostitution. Twenty per cent of prostitutes examined had gonorrhea, fifteen per cent had syphilis, and sixteen per cent of those examined for chancroid had chancroid.<sup>8</sup>

Early in 1942, when soldiers received an increase in pay, the prostitutes increased their prices from \$3.00 to \$4.00. This drew interesting comments from certain columnists and was the source of much ribald conversation, but the price was finally forced down to \$3.00.<sup>1</sup>

An attempt was made to set up a brothel for officers in an exclusive residential area. One of the finer homes in the city was rented by prostitutes and a select trade was being established when the neighbors protested to the police. The house was closed forthwith.<sup>1</sup>

An attempt was made by the Police Department in the autumn of 1942, to drive the prostitutes out of certain residential areas. As the girls claimed to be essential to the welfare of the community and armed forces, they insisted that this attempt to drive them back

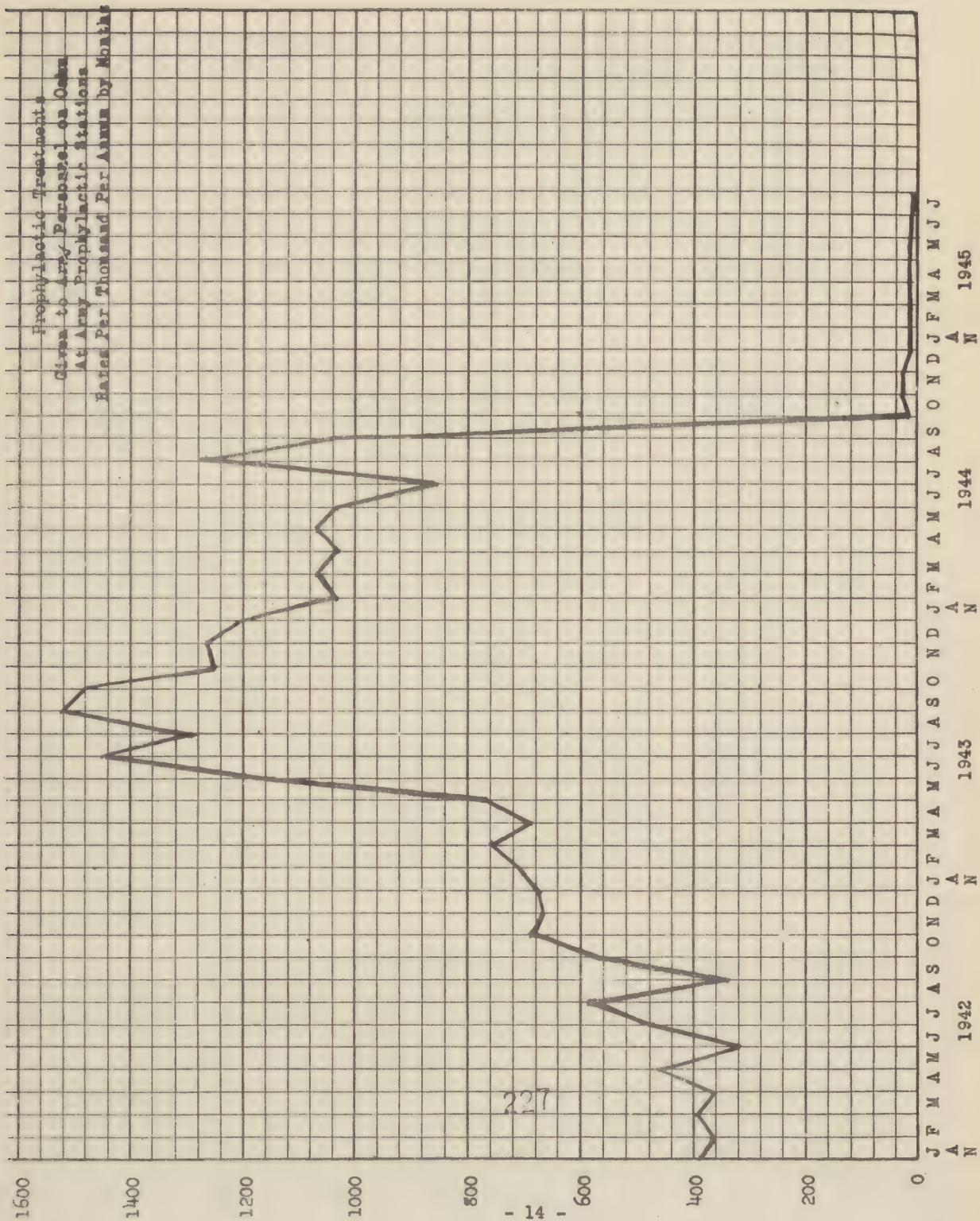
to their brothels was against the Bill of Rights and so they struck. On 31 August 1942, the prostitutes in all houses except three went on strike, and the houses remained closed until 21 September 1942. In the few houses which remained open, business became so good that the girls were overwhelmed. In one place, at the normal closing hour of 1500, the military police found approximately 185 men lined up to visit five girls. The strike was also an expression of indignation of the harsh tone of the Venereal Disease Campaign in the newspapers.<sup>1</sup>

On 21 September 1944, the houses of prostitution in the city of Honolulu were closed. Those in other parts of Oahu and the other islands had been closed previously at various times. The civil police made every effort to discourage clandestine prostitution and the establishment of call houses. The most noticeable effect was in the reduced use of prophylactic station where 51,735 prophylactics were given in Army stations in August, and 31,435 in September, the following three months dropped to 186,297, and 286 respectively.<sup>9</sup> Prior to the closing of the houses thirty to forty per cent of the venereal infections in the area were contracted elsewhere than in the Territory of Hawaii, or were considered "off shipping". Whereas, after the houses were closed, 60-70% of cases were "off shipping". There were no startling immediate change in Army rates because they were already so low.<sup>10</sup>

During the days when prostitution was widespread, every effort was made to develop adequate prophylaxis<sup>1</sup> facilities for the community. Early in 1942, there were but two Army prophylaxis stations in Honolulu, both of which were off the beaten path and neither did a great volume of business. In February, 1942, the Navy opened a station in the red light district and following this the two outlying Army stations showed a sharp decline in their volume. Eventually, when the Army opened stations in the red light district, the volume of business of the outlying stations dropped to such a point that they were finally abandoned. When new stations were established, the volume of business increased sharply.<sup>1</sup>

During the early part of 1942, when there was a large influx of troops, the prophylaxis rate fell. With the addition of new facilities in July of that year, the rate sharply increased but in September during the three-week strike of the professional prostitutes, the rate dropped to almost zero. With the resumption of prostitution the rate continued to go up. In January 1943, the Territorial Health Department was authorized to publicize the availability of a Navy Prophylaxis station to civilians. At that time one of the daily newspapers made mention of this fact on its front page and another on its editorial page. After that the Army also granted similar permission and attempts were made to publicize the availability of both Army and Navy stations to civilians. In addition to prophylaxis









stations, the individual prostitutes were expected to administer prophylaxis to their customers. A study of the type of prophylaxis administered showed that in all instances it was inadequate and in some instances it was actually dangerous in that the solutions used were old and improperly or septicallly handled. In May, 1943, with opening of two new Army stations and the remodeling of the Navy station, prophylaxis was no longer permitted at houses of prostitution, and extensive use was made of placards directing all men to use prophylaxis stations. A sharp increase from about 12,000 prophylaxes in May 1943 to over 25,000 occurred with a significant increase in the proportion of civilians using such prophylaxis facilities.<sup>1</sup>

As mentioned above, the most striking immediate result of closing the houses of prostitution was the reduction in the number of prophylactics given. This trend continued during the remainder of the war, (See Chart II and Table I).

Prior to 1942, sporadic efforts had been made toward a lay educational program in the Territory, but the press and radio were not particularly responsive to these efforts. As late as May, 1942, the newspapers carried all releases submitted by the health department excepting those pertaining to the venereal diseases. In June, of that year, the Hawaii Health Messenger, a publication of the Board of Health, presented the venereal disease picture to its mailing list of physicians, social agencies, and health-minded laymen; and shortly thereafter the Hawaii Magazine, a small independent publication, carried two articles on the subject. At the request of a prominent Honolulu physician, Honolulu's afternoon newspaper reprinted one of the latter articles on its editorial page. Following that, several hundred inches of news release, editorials, letters to the editor, and special articles appeared in all of the Honolulu papers. It was particularly interesting to note that after the papers once started they were willing to publish practically everything released concerning the disease.<sup>1</sup>

One of the most effective educational procedures carried out was that of distributing over 50,000 each of the U. S. Public Health Service pamphlets concerning venereal disease to the Armed Services by methods of distribution which assured that the pamphlets were quickly and effectively scattered. A letter was sent from the Commanding General's Office to the Commanding Officer of each large command, with a sample pamphlet stating that the pamphlets were being given to the unit surgeons. Distribution was made through medical channels by command order; all men were ordered to read the pamphlets and to be prepared to answer questions about them.<sup>1</sup>

TABLE I

Prophylactic Treatments Given to Army Personnel  
on Oahu, T.H., by Army Pro Stations 1, 11, 12

	<u>1942</u>	<u>1943</u>	<u>1944</u>	<u>1945</u>
Jan	1802	7347	19503	113
Feb	1810	7487	16870	73
Mar	2349	7888	18414	85
Apr	2657	7340	19771	66
May	3588	8336	21243	44
Jun	2895	12938	21088	31
Jul	4654	18022	19773	41
Aug	5897	15485	20785	
Sep	3648	19924	12819	
Oct	6381	22014	85	
Nov	7401	19815	153	
Dec	7234	19754	162	
TOTAL	50316	166350	170666	453



Considerable use was made of movies both among the armed services and for civilian groups. No record was kept of the showing to Army or Navy personnel, but over 60 groups of civilians saw Board of Health Films during the period.<sup>1</sup>

Radio stations on the Island of Oahu presented U. S. Public Health Service venereal disease recordings, and the recordings were later used by stations on Kauai and Hawaii.<sup>1</sup>

Prior to the closing of the houses in the fall of 1944, nearly every newspaper carried articles concerning the problem of prostitution in Honolulu.

A serologic survey of colored troops in the Central Pacific area was initiated in June, 1944.<sup>13</sup> This was prompted by the fact that 3,000 troops were surveyed and 46 new cases which had not been previously diagnosed by the Army were found in this group. The survey was suggested by the venereal disease control officer of the Central Pacific Base Command and was carried out under the supervision of the venereal disease control officer for colored troops and the 14th Medical Laboratory. The survey was started in June, 1944, and continued through February, 1945. 11,561 serologies were run with 101 new cases diagnosed. The 101 cases were diagnosed as follows:

Primary	1
Secondary	0
Tertiary	11
Latent	87
Congenital	2
TOTAL	101

General Orders No. 18, HUSAFPOA, 6 February 1945, established a Joint Army - Navy Disciplinary Control Board.<sup>14</sup> This board consisted of the Provost Marshal, USAFPOA; the Senior Shore Patrol Officer, Fleet Shore Patrol, Service Forces Pacific Fleet; the Provost Marshal, CPBC; the Venereal Disease Control Officer, USAPPOA; the Venereal Disease Control Officer, 14th Naval District; and the Venereal Disease Control Officer, CPBC. Included in the duties and functions of the board was the consideration of reports on conditions in the area relating to prostitution and venereal disease, insofar as they applied to service personnel. The board

then recommended designated places or areas "off limits" or "out of bounds". During the first four months after the board was established nineteen rooming houses were placed "off limits" because the proprietors permitted prostitution activities. Nine other areas were also placed "off limits".<sup>6</sup>



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## CHAPTER 34

### Arthropod-Borne Infections

#### (History of Preventive Medicine)

Dengue Fever: The most spectacular epidemic during 1943 was an outbreak of dengue fever. With increased air travel from endemic areas, the possibility that dengue would be introduced into the Central Pacific Area was anticipated. Accordingly, a brief circular was published on 1 May 1943, concerning the mode of transmission of the disease and directing that certain precautions be taken to prevent the introduction and dissemination of dengue.<sup>1</sup> In spite of precautions, three (3) cases were brought to Oahu in the month of July. These were in non-military personnel and were not discovered immediately. In three weeks two (2) civilian cases appeared in the Waikiki area of Honolulu, and twelve days later two (2) Army cases occurred in Ft. DeRussy in the Waikiki area.<sup>2</sup> Measures were taken immediately to prevent an explosive outbreak<sup>3,4,5,6,7,8,9,10</sup> and it was gratifying to note that such an outbreak was prevented. Although 1,355 civilian cases occurred through December 31st, only 56 cases occurred in military personnel. Control measures consisted chiefly of an intensive widespread mosquito control program. Military commanders throughout the Central Pacific Area were directed to eradicate adult mosquitoes, larvae, and breeding sites, within a distance of one-quarter mile of all installations, however small, in the Central Pacific Area. Proper screening of patients in hospitals and homes was made mandatory. Large areas of the city of Honolulu were placed "off limits" to troops, as foci developed in these areas.

As soon as any area was found to be a focus of infection by the appearance of large numbers of civilian cases of dengue in that area, it was declared out of bounds to troops. This procedure for isolating infected civilians and mosquitoes from military personnel was very effective in preventing the spread of disease to members of the armed forces, who might otherwise have mingled with civilians and been bitten by infected mosquitoes in the vicinity. Inter-island travel was curtailed. All cases of dengue were investigated epidemiologically as they occurred and mosquitoes (adult and larvae) were eliminated from infected premises.

Assistance was given freely to civilian agencies in Dengue Control for effective control in the military establishments

was not possible without adequate control in civilian areas. A Medical Officer was attached to the Territorial Board of Health for the purpose of making epidemiological studies of all new cases. Fifty (50) enlisted men were assigned to spray the premises and eliminate breeding places in whatever homes dengue appeared. When a comprehensive systematic program for elimination of breeding places in Honolulu was begun, sixty-six enlisted men were furnished for the work. This was necessary, as adequate civilian labor was not available. Trucks, ladders, and spraying equipment, including 400 gallon power sprayers, were made available for use by civilian agencies. The initiative taken by the Army was believed to have been most important in preventing an explosive outbreak which might have resulted in a disastrous noneffective rate within the command.<sup>2</sup>

Dengue fever on the island of Oahu was brought under control during the early part of 1944. The disease had been confined almost entirely to the civilian population.<sup>2</sup> Six (6) cases of dengue fever were reported to the Board of Health from the civilian population in June 1945. The date of onset of the first case was 26 May.<sup>11</sup> As soon as the reappearance of dengue in the civilian population was known, an immediate action letter was issued to the Command requiring that each unit commander eliminate Aedes breeding places from his area.<sup>12</sup> A standing order, which required permanent control of Aedes breeding by unit commanders existed, but in the presence of dengue it was felt wise to reemphasize the necessity for Aedes control.

A permanent dengue control program was in operation in Honolulu following the 1943 epidemic. This control program was supervised by the United States Public Health Service, although most of the personnel carrying out the program were soldiers from a Medical Service Company. The city of Honolulu was divided into zones of such size that one inspector could cover each premise in his zone every ten days and remove or treat each Aedes breeding place. Later because of a shortage of personnel only the most thickly populated areas could be covered every ten days, and less densely populated areas were covered as often as possible. Certain zones were felt to be critical either because of the dense population or because of heavy mosquito breeding. Due to terrain and meteorological conditions, weather conditions vary greatly on Oahu every few miles. Thus it seldom rains in Waikiki but rainfall is heavy in the mountains and valleys three or four miles inland. The Waikiki area was considered critical because it was densely populated even though relatively dry. The Nuuanu Valley area was critical because although the population was sparse, rainfall occurred daily. Whenever a suspected case of dengue was reported, a clean-up crew made a special inspection in and about the premises to eliminate Aedes larvae and to carry out



wide scale spraying to kill the adults. During June 1945, when a second outbreak was threatening, an Army epidemiologist examined each suspect to confirm or rule out the diagnosis of dengue. It was felt that in the majority of cases, the diagnosis was not correct. No proven cases of dengue occurred in military personnel and there was no widespread outbreak among civilians.<sup>13</sup>

Endemic Typhus: Cases of endemic (murine) typhus fever have been reported in military personnel in the Hawaiian Islands since 1942. The table below shows the incidence of the disease from 1942 through the first eight months of 1945. Figures prior to 1942 are not available. Cases were mild and there were no fatal cases. A rat control program was initiated by the Army in March 1943 and as this became increasingly effective, it will be noted that the incidence of military typhus cases decreased. All cases of endemic typhus fever were investigated for probable sources of infection and for adequacy of rat control measures in the bivouac area of the patient.<sup>2,13,14</sup>

<u>Typhus Cases:</u>	<u>Cases</u>	<u>Rate</u>
1942	16	0.16
1943	69	0.47
1944	31	0.17
1945 (8 mos)	6	0.10

Filariasis: No filariasis was reported among troops in the Central Pacific Area, but in 1943, 199 cases were received from the Air Transport Command in the South Pacific Area for evacuation to the Mainland.<sup>2</sup> The only source of filariasis within the Central Pacific Area was the Apamama Atoll, Gilbert Islands Group. All cases seen in this area were mild, the manifestations being almost subclinical. The maximum time of exposure of troops to the disease in this area was five months. Diagnosis was based upon residence in a filariasis endemic area, history of pain in lymph nodes and along lymphatic channels, thickening of the spermatic cords of lymphatics of the limbs, generalized or localized lymphadenopathy, occasionally localized swellings, eosinophilia, or positive reactions to skin or complement fixation tests with *Dirofilaria immitis* antigen. Microfilariae were not found in the blood. An epidemiological team was sent to Apamama Atoll in May 1944, to study the disease. Twenty-two and four tenths per cent of a group of native laborers in close contact with the affected troops was found to carry microfilariae. A few adult *Aedes scutellaris*, *pseudoscutellaris* and innumerable *Culex quinquefasciatus* mosquitoes were found present. *Culex* mosquitoes which were raised from larvae, were allowed to feed on a native microfilaria carrier, and after eleven days, numerous infectious larvae were found by dissection. The scarcity of *Aedes* mosquitoes was thought to have resulted from several

weeks of dry weather. Wild adult Aedes mosquitoes were caught after feeding on a native microfilaria carrier, but these survived only one or two days in captivity. Some of them were observed by immediate dissection to have taken up microfilariae. It was the conclusion of the epidemiological team that the diagnosis of filariasis in the suspected cases was epidemically sound. It was the policy of the Central Pacific Area and the Central Pacific Base Command to evacuate all patients with filariasis to the mainland in accordance with (TB MED 142, February 1945).<sup>13</sup> Between June 1945 and the cessation of hostilities in August, over 4,000 Prisoners of War from Okinawa were received in the Hawaiian Islands. It was anticipated that this group might contain many carriers of disease. Accordingly arrangements were made to examine stool and blood for parasites and to perform Kahn tests on the entire group. Thick blood smears were taken at night (1900 - 2200), stained with Giemsa's and examined for microfilariae. Microfilariae were found in the blood of 16% of the 4,563 prisoners examined. Both Wuchereria bancrofti and W. Malayi were found; the former principally in Japanese prisoners, the latter, in Korean.<sup>15</sup> These prisoners were returned to Okinawa as soon as a positive diagnosis was made and shipping was available. Prior to their departure, extensive mosquito control measures were effected in and around the prisoner of war compound.<sup>16, 17</sup>

Malaria: 69 cases of malaria were reported during 1942 but there was no evidence that any of the cases were contracted within the Hawaiian Islands. This disease was not a problem in the CPA, since no Anopheline mosquitoes were known to exist in the area, and efforts were constantly made to exclude their being introduced. Troops departing from the CPA for malarious regions were supplied with atabrine and other malaria control items when necessary. Such troops were given a course in malaria control in accordance with War Department Circular No. 223, 21 September 1943 and Training Circular No. 108, 21 September 1943.<sup>2</sup> The number of cases of malaria hospitalized increased in 1943 and 1944 as the result of the arrival of personnel from malarious areas in the South and Southwest Pacific.<sup>11</sup> These cases were all of the Vivax type. Malaria discipline had not been thoroughly enforced in this group.

Patients evacuated from malarious areas in 1945 increased the malaria admissions in CPBC hospitals again.

Malaria:	<u>Cases</u>	<u>Rate</u>
1942	69	0.67
1943	154	1.04
1944	95	0.51
1945	134	2.25



Rodent plague is endemic in the Hamakua District of the Island of Hawaii, and the Makawao District of the Island of Maui. The last human case in the Territory of Hawaii prior to 1943 occurred in the Makawao District in 1938. From March to August 1943, five human cases occurred in the Hamakua District of Hawaii. All these cases were fatal. In December 1943, two fatal cases occurred in the Hamakua District. There were no cases in military personnel. This was believed to be due in large measure to a rigidly enforced, systematic, supervised rat control program in all military organizations in the Central Pacific Area. The plague reservoir for this area is the *Rattus Hawaiiensis*.<sup>2</sup> The facilities of the Plague Laboratory on the Island of Hawaii were expanded during 1944 to include the bacteriological determination of plague. During the year 1944, there were five human and sixty rodent cases of plague diagnosed on the island of Hawaii; no human cases occurred and only one rodent case was found on Maui. There were no military cases. Neither human nor rodent plague had been found on Oahu or Kauai since the early years of this century.<sup>13</sup> A study of the effect of penicillin treatment upon plague infected guinea pigs showed the drug to have no value.<sup>18</sup> In 1945 a patient on Hawaii survived from 23 April 1945 to 2 June with bubonic plague. The patient had been immunized and had been treated with sulfonamides and was expected to recover, but died of hemorrhage from the iliac artery which was eroded by a large abscess in the iliac fossa.<sup>19</sup>

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## CHAPTER 35

### Miscellaneous Infections

#### (History of Preventive Medicine)

**Poliomyelitis:** From the beginning of the war until April 1943, no cases of poliomyelitis occurred among military personnel, although forty-three cases occurred among civilians on Oahu during the same period. In March 1943, poliomyelitis became unusually prevalent in the civilian population, sixty-six civilian cases occurring during the remainder of the year (March to October). There were four cases of poliomyelitis among military personnel on Oahu during the months of April-June, 1943.<sup>1</sup> The Kuakini Hospital (later an annex to Tripler General Hospital) hospitalized the military cases. The Army assisted civilian authorities in the establishment of a poliomyelitis hospital in 1943, operated by the Office of Civilian Defense. This assistance included the use of Drinker respirators which were subject to immediate recall if needed by military personnel. The Kenney method of treatment was used with good results. The Command was notified of the outbreak and instructed to take generally accepted preventive measures which were enumerated. Since June, 1943, no further cases of poliomyelitis were seen among troops until 1945, when eleven cases were evacuated from Leyte to Oahu in January and February, and two cases were taken off transports from the mainland in August.

**Yaws:** The Navy imported twenty-one Ellice Island natives to Canton to work as laborers in May of 1943. Yaws was noted among these natives and following a request from Headquarters Central Pacific Area, further importation of native laborers to that station was discontinued. All infected natives were treated with arsenicals by Army medical officers as a means of preventing dissemination of the disease. No cases occurred in military personnel. In December, the British government imported forty-one infected male natives to Christmas Island for the purpose of working copra plantations. These were treated and rendered noninfectious. Examinations were made to discover other communicable diseases in the group and steps were taken to protect the Command.<sup>1</sup>

**Leprosy:** This disease is present in civilians in the Central Pacific Area but was not of military importance. Lectures and clinics were conducted for medical officers who might enter leprosy areas.<sup>1</sup> Four cases of leprosy in military personnel were reported in 1942 and one in 1944.<sup>2</sup> These cases were in local men who were inducted into the Army from the Hawaiian Islands. Presence of the disease was not recognized prior to induction.

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## CHAPTER 36

### Nutritional Diseases

1. Calorie Deficiencies. - The overall food supply in the Hawaiian area during the war was in general adequate to maintain normal weight among the troops. On some of the forward islands, however, the monotonous "B" ration diet caused inadequate caloric intakes in some instances.

During the first two months after occupation of Makin atoll (early 1944) it was observed by a medical officer that there were many instances of weight losses of 5 to 10 pounds among the garrison. Monotony of field ration "B", alleviated only by negligible issues of fresh food, was cited as the principal cause, together with early shortages of sugar, coffee, flour, baking powder and canned fruit and vegetables. When increases in these items and fresh foods were received, the ration became more palatable and most of the weight losses were regained. No vitamin deficiencies were observed; an issue of two vitamin tablets daily per man was instituted in the third week of occupation.<sup>1</sup>

In a report covering feeding conditions on APO 241, Kwajalein, from 1 February to 5 May 1944 another medical officer observed that weight loss was the rule during that period. Inadequate appetite was attributed chiefly to monotony of the "B" ration, particularly the limited variety of meat components and the unpopularity of the canned stew, Spam and chili & beans. Poor preparation and serving of food also contributed, and the menu was considered not well suited for field use. The early provision of ice-making equipment was recommended, as well as the assignment of a nutrition officer to large garrison forces to supervise the cooking and serving of food.<sup>2</sup>

2. Vitamin and Mineral Deficiencies. Whether or not there were adequate amounts of specific nutrients in the rations throughout the command remained uncertain during the war.<sup>3</sup> The use of vitamin capsules in forward areas would have tended to prevent any widespread incidence of specific vitamin deficiency even if the ration had furnished insufficient amounts.

Prior to June 1945 no analysis was made of the dietary as actually consumed to determine whether the vitamin intake was low enough that specific deficiencies might be likely in any considerable proportion of the troops. At that time estimated intakes of thiamin, riboflavin and calcium by troops served by one depot (APO 957) on Oahu were found to average slightly below the

National Research Council standards, but not sufficiently low that overt symptoms might be expected.<sup>4</sup>

Sanitary Reports occasionally stated that the diet of certain units was lacking in vitamins, but no conclusive demonstration of deficiency symptoms was made. In a few instances information suggestive of minor deficiencies was reported, but no data on the dietary intake nor on controlled response to vitamin therapy was included.

In August 1942, a station hospital reported that a decreased healing time for minor cuts and injuries had been observed when vitamin capsules had been used by the troops for several weeks, and that susceptibility to infection was also lessened.<sup>5</sup>

In August 1943, a battalion surgeon reported that capillary fragility was demonstrated in 22%, and marked sponginess of the gums in 26% of a sample of his troops. He attributed this to inadequate ascorbic acid in the consumed ration, but no data on the actual ascorbic acid intake were provided. Measures were taken to instruct mess personnel in methods of food preparation to preserve ascorbic acid values.<sup>6</sup>

Request was made in November 1943 for supplemental vitamins to be issued to an infantry regiment on Oahu. The regimental surgeon stated that the dietary had been variable for the past two years, averaging barely adequate as to vitamins and consistently inadequate in calcium. He felt that optimal nutritional supplies were advisable to further recovery from injury or illness in troops going into battle. No data were presented on the actual dietary intake of vitamins and minerals by the troops.<sup>7</sup>

In May 1944, the surgeon at APO 241, Kwajalein, reported the appearance of swelling and bleeding of the gums and neuritis among the troops of that area, and considered it likely that it was due to the limited variety of food. A 90 day supply of multivitamin capsules for all personnel was forwarded.<sup>8</sup>

In June 1944, eye symptoms attributed to riboflavin deficiency was reported in patients at the 156th Station Hospital on Kauai, photophobia, a feeling of grit in the eyes, blurring under close work, headaches, and proliferation of the limbus plexus into the cornea. The cases were said to respond to riboflavin therapy, although no controlled trials were reported.<sup>9</sup>

In April 1945, a nutritional survey of troops on Hawaii by a team from the SGO revealed no classical deficiency syndromes, and there was a low incidence of signs commonly attributed to malnutrition. The biochemical status of the subjects was good and their dietary intake was only slightly below National Research Council standards in calcium and riboflavin.<sup>10</sup>



HEADQUARTERS UNITED STATES ARMY FORCES CENTRAL PACIFIC AREA  
OFFICE OF THE SURGEON

APO 958

In reply refer to:  
(Surg)

23 May 1944

SUBJECT: Nourishment of Personnel at an Advance Base.

TO: The Surgeon, Central Pacific Area.

1. The ration provided the garrison at Makin Atoll, during the first two (2) months, was the type "B" tropical field ration. Only a negligible quantity of fresh foods were issued. Two (2) vitamin tablets daily per man were issued to all personnel, beginning about the third week ashore. This was a very monotonous diet and many men did not eat sufficient to maintain their normal weight. As a result, there were numerous instances of weight losses of 5-10 pounds per man. The greatest lack in this ration seemed to be shortages of sugar, coffee, flour, baking powder, and canned fruit, and vegetables. Action by the Island Commander resulted in increases in all of these items. Due to the warm, humid, monotonous climate, a concentrated diet rich in fats and proteins is not nearly as appealing as one with a preponderance of carbohydrates.

2. After the first two months, fresh foods, meat, eggs, butter, fruit and vegetables were received and a much more palatable ration was issued. Most of the weight losses mentioned were regained at time time.

3. In general the nourishment and weight of all personnel in the command was good at the time of departure of the undersigned. There were never any evidences of vitamin deficiencies.

A TRUE COPY:

/s/ Charles D. Buss  
CHARLES D. BUSS  
1st Lt, SnC

s/ William E. Strozier  
t/ WILLIAM E. STROZIER,  
Lieut. Col., M. C.,  
Assistant.





SUBJECT: Weight Loss in Forward Area.

MEMO TO: Col. Gates.

1. The undersigned was at APO #241 during the period 1 Feb - 5 May 44.

2. During this period my weight dropped from 198# to 186#. Since my return I have gained 4#. Weight loss was the rule at this area and can be attributed to the following factors.

a. Initial Dehydration.

b. Loss of appetite and consequent small meals due to:

1). Unpalatability of rations.

a). The C and K rations eaten during the first 15 days were not at all palatable. Biscuits of the K ration and the meat and vegetable stew and hash of the C ration were the biggest offenders. A hearty meal cannot be eaten of these components.

b). In the B ration, practically all the components except the stew, spam and possibly chili and beans were very popular when prepared with some imagination by the mess personnel (the three components mentioned are never popular, although spam can be prepared so that it is at least edible). It was noted though, that even in what was considered an exceptionally fine mess (2nd Prov. Stn. Hosp.), those who ate there consistently complained of monotony. Food warmed up and served sloppily is the biggest factor in poor eating.

2). Unsuitability of the menu. The menu prepared for our use on which basis the ration was issued, was not made up by a person familiar with field or tropical conditions. Items were on the menu which either could not be prepared in the field or if they could a man could not easily use his mess kit to eat it (example: soup; needs the canteen cup, which must then be washed before used for the drink, and no man likes to get up in the middle of a meal to wash a cup for his coffee). The menu frequently had an overabundance of carbohydrate foods. The heaviest meal was usually at noon, when the heat of the day made appetites poor.

3). Monotony of the ration was the biggest fault; due to pilfering perhaps of canned chicken and ham soon after the garrison forces were landed. Spam, corned beef, hash and stew and chili and beans were the principal meat components - just a little chicken or ham would have relieved the monotony. A noticeable increase in

morale was evident after about 18 April, when enough fresh food was available for one fresh meal a day, including fresh meat.

3. Recommendations: (See also Veterinarian Report on APO #241.)

- a. Increase palatability of K ration, especially biscuits.
  - b. Eliminate C ration hash and stew and substitute something a man can chew on.
  - c. A competent food and nutrition officer, familiar with all the items of the B ration, and familiar with field cooking, be assigned to large garrison forces to actively supervise the cooking and serving of food. In other words, an officer with the imagination and ability to make ordinarily monotonous foods palatable and "exciting".
  - d. Early and adequate ice making machines for icing of drinks.
- All Navy and Marine units on the main island were equipped to start off with reefers or large iceboxes, and two of these units had chip and snow ice making machines. Needless to say, Army personnel, including myself, were loud in our exclamations of wonder as to why the Army couldn't have the same things.

s/ J. F. M.  
t/ JOSEPH F. MAGUIRE,  
Major, MC.

A TRUE COPY:

s/ Charles D. Buss.  
CHARLES D. BUSS  
1st Lt, SnC



HEADQUARTERS CENTRAL PACIFIC BASE COMMAND  
Office of the Surgeon  
APO 956

18 August 1945

SUBJECT: Nutritional Analysis of CPBC Menus.

TO : Surgeon  
Central Pacific Base Command  
APO 956

1. In accordance with verbal request, nutritional analyses were made of the rations planned and issued at APO 957 for the month of June 1945.

2. As compared to the recommended allowances of The Surgeon General's Office, the rations planned were adequate in all specific nutrients. The rations as actually issued, however, fell below the recommended standards in calcium Vitamin B<sub>1</sub> and vitamin B<sub>2</sub>. This was due to lack of acceptance by organizations of the full amounts of certain foods, notably evaporated milk, flour and vegetables.

3. Two measures currently under way will improve the nutritional situation:

a. A new CPBC 15-day menu is being formulated which will incorporate new recipes to make certain foods more acceptable to the men.

b. An active educational program at the School for Bakers and Cooks is stressing proper food preparation and the importance of using the full allowances of essential foods.

4. Since a new CPBC menu is being prepared, and since adequate surveys of the present menu have been obtained, it is suggested that the QM, CPBC, be notified that the submission of issue records for analysis may be discontinued for the present. Close liaison is being maintained with the Subsistence Officer.

1 Incl:  
Ration Analysis,  
APO 957, June 45.

CHARLES D. BUSS  
1st Lt. Sn. C.  
Nutrition Consultant





HEADQUARTERS  
CENTRAL PACIFIC BASE COMMAND  
OFFICE OF THE SURGEON  
APO 958

RATION EVALUATED As Issued, June 1945 ORGANIZATION APO 957

FOOD CLASSES PER AVERAGE RATION --	As	As
Pounds per Man per Day	Planned	Issued
Meats.....	.967	.853
(Pork).....	(.111)	(.080)
Eggs (fresh equivalent).....	.187	.177
Milk products (liquid equivalent).....	.789	.679
Butter.....	.070	.067
Fats, other .....	.075	.066
Grain products.....	.821	.608
Legumes, dry.....	.098	.059
Sugars.....	.450	.313
Vegetables, leafy, green and yellow.....	.416	.294
Tomatoes.....	.206	.162
Citrus fruits.....	.353	.326
Potatoes, white.....	.750	.631
Vegetables, other.....	.329	.218
Fruits, other.....	.339	.319
Fruits, dried.....	.059	.025
TOTAL	5.909	4.797

NUTRITIVE VALUES PER MAN PER DAY-- Corrected for

<u>estimated</u> edible garbage loss of <u>10%</u>	As	As	Recommended
	Planned	Issued	Allowances
Energy, Calories .....	4430.	3550.	3500.
Protein, grams.....	132.	107.	70.
Fat, grams.....	188.	165.	
Carbohydrates, grams.....	549.	420.	
Calcium, grams.....	.9	.7	.8
Phosphorous, grams.....	1.9	1.6	
Iron, mgms.....	27.	21.	12.
Vitamin A, Int. Units.....	15100.	8360.	5000.
Vitamin B <sub>1</sub> , mgms.....	3.0	2.2	
"    "    " (corrected)*.....	2.3	1.7	1.9
Vitamin B <sub>2</sub> , mgms.....	2.7	2.1	
"    "    " (corrected)*.....	2.3	1.8	2.1
Nicotinic Acid, mgms.....	32.	25.	
"    "    " (corrected)*.....	26.	20.	19.
Vitamin C, mgms.....	150	117.	
"    "    " (corrected)*.....	105	89.	75.

\*Corrected for probable preparation and cooking losses.

COMMENTS: 1. The "As Planned" ration represents the food offered to the organizations; the "As Issued" represents the food accepted.

2. The considerable proportions of each food class that were not accepted by organizations at time of issue are reflected in the lowered nutrient intakes of the "As Issued" ration. The intakes of calcium, vitamin B<sub>1</sub> and vitamin B<sub>2</sub> are below the amounts recommended by The Surgeon General.

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## CHAPTER 37

### Environmental Disease

#### (History of Preventive Medicine)

There has been no significant incidence of environmental diseases in the Central Pacific. The climate is moderately warm and comfortable with very little variation. Cases of heat stroke and heat exhaustion have been very rare and have only occurred as a result of strenuous exercise in the direct sun. Cases of severe sunburn are not uncommon, but they occur only as a result of indiscretion in sun bathing. Cold injuries have been nonexistent.





## CHAPTER 38

### Extra Military Sanitation and Liaison Activities (USPHS).

#### (History of Preventive Medicine)

#### Section I: Headquarters Hawaiian Department (7 December 1941 to September 1943).

On 7 December 1941, the Territory of Hawaii was placed under martial law. The Commanding General, Hawaiian Department became the Military Governor of Hawaii. Full martial law over the Territory existed until March 1943, at which time certain civilian functions, including matters of civilian public health, were returned to the civilian government.

During the period 7 December 1941, to March 1943, the Hawaiian Department Surgeon was responsible to the Military Governor of Hawaii for the investigation and determining of all factors which affected the health of civilians as well as military personnel, and for recommending and supervising measures for the control of disease and the provision of adequate medical care for the entire Territory. The magnitude of this responsibility was tremendous.

The Territory had been attacked by the Japanese without warning. The land mass was small, and military personnel and civilians necessarily worked in intimate contact with one another. The civilian population was over half Japanese, among them many enemy aliens or individuals of dual, American and Japanese citizenship. Medical facilities were not adequate to care for the military and civilian casualties which could be expected in event of enemy invasion. Both Army and civilian hospital facilities to be expanded, blacked-out, and splinter-proofed. Materials, supplies, and personnel for the construction and operation of hospitals became critical, and decisions as to priorities had to be made. Troops previously in garrison moved to field positions largely on privately owned land, and satisfactory sanitary expediences for them had to be provided and supervised. Troop reinforcements arrived in large numbers to defend the Territory, and military camps and medical facilities expanded rapidly, particularly on the Islands of Hawaii, Maui, and Kauai. A large number of troop units lacked training in field sanitation, and any deficiencies in either civilian or military sanitation affected both. The United States Engineering Department hired large numbers of civilian

employees and established camps for feeding and housing them. The Office of Civilian Defense required supervision, and frequent inspections were necessary to insure that adequate provision had been made for civilian evacuation, housing, food and medical care in event of enemy attack or epidemic. Food and water supplies had to be protected against accidental or enemy contamination. Problems in waste disposal and mosquito and rat control developed because of labor shortages. For a period, private incinerators could not be used and large dumps could not burn through the night hours because of black-out restrictions. Dependents of military personnel and other civilians had to be evacuated to the mainland. Civilian Army and Navy employees began to arrive from the mainland to swell the City of Honolulu. Restaurant and rooming facilities became over crowded, and many temporary facilities opened with inexperienced operating personnel and inadequate equipment. The Territorial Board of Health was unable to adequately inspect and supervise these establishments without assistance from the Army. Close liaison was necessarily maintained with the Territorial Board of Health.

The rapid growth in the population of the City of Honolulu, with the introduction of numerous war workers and military personnel on pass who crowded restaurants and rooming houses, resulted in many sanitary problems. The staff of sanitary inspectors of the Territorial Board of Health became greatly undermanned. Many of the older inspectors of the Board of Health were alien Japanese who were now restricted in their activities. Every effort was made by the Board of Health to hire more inspectors, but men with the necessary experience could not be found. It became evident that Army assistance was necessary if adequate sanitation was to be maintained. Upon the recommendation of the Surgeon, Hawaiian Department, a detachment of Medical Department enlisted men were placed on detached service to the Territorial Board of Health for sanitary inspection of civilian restaurants, rooming houses, and for other general purposes. These enlisted men were first given a course of instruction in sanitation by Medical Department officers, and then were placed with the civilian inspectors of the Board of Health for practical experience.<sup>1, 2</sup> Approximately thirty of these technicians began routine inspection work in Honolulu in September 1942. Although the number of these inspectors has gradually been reduced, and replacements have been added from time to time, this Army service has continued through September 1945. In March, 1943, when responsibility for the protection of public health was transferred back to the civil government, a special request was made by the Civil Governor to the Commanding General, Hawaiian Department, for the retention of the



Army sanitary inspectors with the Board of Health for as long as the military situation would permit.<sup>3</sup> In August 1944, when the 114th Medical Service Company was activated, these sanitary technicians were transferred from detached services from many different Medical Department units to the Table of Organization of that organization. For the duration of full martial law the work of the Army sanitary inspector was very effective. Insanitary restaurants and rooming places were charged stiff fines by the Provost Courts. After March 1943, the work of the sanitary inspectors in civilian establishments became largely educational, as convictions in civilian courts have been very hard to obtain.

The rapid increase of Army, Navy and civilian defense work personnel on the Island of Oahu during the early part of the year 1942, greatly increased the demand upon the already over-taxed garbage and rubbish disposal facilities of the City and County of Honolulu. To make matters worse, many employees of the City and County left their jobs to take defense jobs offering higher pay. Black-out regulations had restricted the use of private incinerators and the burning of the large City and County dumps. These factors contributed to a generally prevalent insanitary situation on civilian properties, and resulted in increased breeding of flies, mosquitoes, and rodents. Particularly important was the definite increase in the rat population in Honolulu. With the ever present menace that plague might spread to Honolulu from endemic foci on the Islands of Maui and Hawaii, this was considered a most dangerous situation. Upon the recommendations of the Surgeon, Hawaiian Department, a complete study of the problem was undertaken by all interested military and civilian agencies. As a result of this study, there was published Section II, General Orders No. 122, Office of the Military Governor, dated 1 July 1942.<sup>4</sup> The use of private incinerators by householders was encouraged with certain restrictions. Regular garbage and rubbish collection service was provided. All collected garbage and rubbish was to be disposed of by incineration at the City incinerator or by hauling by railroad to the City's remote dumping ground near Kaena Point. Certain authorized dumps were established throughout rural Oahu, and it was directed that only these authorized dumps be used. These dumps were properly maintained, provision was made for burning and marked with signs reading "Official Rubbish Dump - By Order of the Military Governor". Necessary publicity was given to the locations of these dumps. The Army contributed a pro rata share of the cost of preparation and maintenance of dumps and incineration facilities, according to Army use. The disposal of suitable wet garbage to hog farmers by both military organizations and civilian establishments was encouraged.

The effect of General Orders #122 was a marked improvement in sanitation. Considerable work had to be done in cleaning up insanitary accumulations of rubbish at unauthorized locations. Much of this work was done by Army details. Many of the authorized dumps had large accumulations of unburned combustible material which could not be burned during one daylight period. Special arrangements were made for burning these large accumulations on specified moonlight nights, after which burning during daylight was sufficient. In addition to the remote dump location, a dumping site was located in the vicinity of Honolulu for the emergency disposal and burning of rubbish which could not be hauled in any one day by the railroad.

Large amounts of rubbish of all kinds still remained in the backyards and vacant lots of the City of Honolulu. The civilian population was busy with war work, many leaving for work before dawn and returning to their homes after sunset. The rubbish collection trucks of the City of Honolulu were working at full capacity. Upon the recommendation of the Surgeon, Hawaiian Department, Section I, General Order #137, Office of the Military Governor, dated 11 September 1942, was published, providing for a city-wide clean-up. The Army provided extra trucks and prisoner labor for the collection of the large amounts of extra rubbish brought to the curbstones. All householders were required to clean-up under penalty of fine not to exceed \$100.00. So successful was this clean-up campaign that it was impossible to collect all the rubbish brought to the street during the month period allotted, and Army assistance was continued for an additional two weeks.

Army liaison with civilian agencies in connection with garbage and rubbish disposal has continued. In March, 1943, General Orders #122 was rescinded, along with the return of responsibility for other public health matters to the civil government. Nevertheless, the general scheme for Army-Civilian cooperation in the disposal of garbage and rubbish has continued in effect.

In order to safeguard the sanitation of the various watersheds on the Island of Oahu and to inform newly arrived troops of the regulations concerning entry into watersheds, Hawaiian Department Circular #132, 27 December 1942, was revised as Headquarters, Hawaiian Department Circular #43, dated 31 March 1943 and given wide distribution. The latter directive was again revised to include the other Hawaiian Islands and was republished 5 January 1945, as Headquarters, CPBC, Administrative Order #1 (Index 700.90).<sup>5</sup>

The Army has cooperated closely with civilian public health officials in the control of plague and rodents.



Plague was introduced to the Hawaiian Islands in December 1899, as part of a large epidemic originating in China and spreading to India in one direction, and to Manila, Honolulu, and San Francisco in another. From Honolulu, the disease spread to the principal parts of Hawaii, Maui, and Kauai during the succeeding five months. By 1906, evidence of both human and rodent plague had died out on Kauai, and by 1910, the disease had disappeared from Oahu. Plague has remained endemic, however, in one area on Maui (Makawao-Paia) and another on Hawaii (Hamakua District). Sporadic cases of human plague have occurred. Since 1910, plague control in the Hawaiian Islands has been limited to these two areas. Prior to the war, plague control activities were carried on under the supervision of the Territorial Board of Health, with the financial assistance of the U. S. Public Health Service, the Hilo Shippers' Wharf Committee, the Maui Quarantine Tax Fund Commission, and the Voluntary Tonnage Funds of the Chamber of Commerce of Honolulu. In 1941 the Board of Health had 68 full time personnel in anti-plague work. Of these the Board of Health provided funds for the employment of 39, the U. S. Public Health Service 14, and the other agencies 15.

During the period of complete martial law, 7 December 1941 to March 1943, the Office of the Military Governor had coordinated Army and civilian activities in a clean-up of the City of Honolulu, and in a program for garbage and rubbish disposal for the Island of Oahu. The Territorial Board of Health had continued its plague control program on the Islands of Maui and Hawaii. The clean-up on the Island of Oahu, particularly around Honolulu Harbor, had been considered as a protective measure against the introduction of plague into Oahu from the foci on the Islands of Maui and Hawaii. During the years 1938-1942 on Maui, and 1940-1942 on Hawaii, there were no cases of human plague reported, although the Territorial Board of Health found the continued presence of rodent plague.

During March 1943, two cases of human plague occurred in the Hamakua District of the Island of Hawaii. The direct responsibility for the public health of the Territory had already been returned by the Military Governor to the Civil Governor. Nevertheless, the Commanding General, Hawaiian Department, in a letter to the Governor of the Territory, dated 3 April 1943, emphasized the importance of increased plague control activity on the Island of Hawaii and offered whatever cooperation was necessary.<sup>6 7</sup> During the next few months the plague control program was increased with the financial assistance of the Office of Civilian Defense. Fifteen additional personnel were employed for each of the plague districts.<sup>8</sup> More emphasis was placed upon

rat control in and around human habitations in the Hamakua District. A third case of human plague occurred in the Hamakua District in April, a fourth in May, and a fifth in August. In August the Office of Civilian Defense announced that it could not continue financial support of the program much longer. On 17 September 1943, the Commanding General, Hawaiian Department, wrote The Adjutant General, Washington, D. C., fully explaining the emergency and urging that representation be made to the Civil Governor to provide additional anti-plague work be made available to him promptly, and that action be taken to insure continuation of a vigorous anti-plague campaign in the Territory of Hawaii.<sup>9</sup> This letter was answered on 27 September to the effect that The Surgeon General had been informed of the situation and was making the necessary representations to the United States Public Health Service and the Department of the Interior. The necessity for an Aedes mosquito control program for the Territory as a safeguard against the introduction of yellow fever was also referred to the War Department at about this same time. The solution reached in Washington was to set up United States Public Health Service, District No. 10, Territory of Hawaii, for the coordination of Army and civilian activities and to provide United States Public Health Service personnel and funds as necessary for both a satisfactory rodent and Aedes mosquito control program.<sup>10</sup> The Senior Surgeon for the new District arrived in the Territory in November 1943, and a specialist in rodent and plague control in February 1944. A complete study of the rodent and plague situation on Maui and Hawaii was accomplished, and radical changes in the program resulted. The Hamakua plague campaign force was doubled, with the expansion of personnel from 45 to 93 employees. The Office of Civilian Defense continued to support the program until June 1944, the Civil Governor provided funds through September 1944, and the United States Public Health has provided the funds through September 1945. A total of 11 human plague cases had occurred in the Hamakua District of Hawaii by April 1944, at which time the majority of the inhabitants were given immunizations against plague. From April 1944, through September 1945, there have been only two additional human cases. A tabulation of human and rodent plague cases by years is shown below:

Plague Cases in Hawaiian Islands

<u>Year</u>	<u>Maui</u>		<u>Hawaii</u>	
	<u>Human</u>	<u>Rodent</u>	<u>Human</u>	<u>Rodent</u>
1941-42	0	1	0	54
1942-43	0	7	4	157
1943-44	0	8	7	63
1944-45	0	1	2	31



During the fiscal year 1944-45, the personnel employed in plague control activities were as follows:

Hawaii	87
Maui	49
Oahu	6-20
Kauai	7

A total of 339,535 rodents were retrieved during the fiscal year 1944-45:

Hawaii (Hamakua District)	151,800
Hawaii (Hilo)	59,789
Maui	60,505
Kauai	45,529
Oahu	21,912
<u>Total</u>	<u>339,535</u>

Along with changes made in the rodent control program, more adequate facilities were set up on Hawaii for the accurate bacteriological diagnosis of plague and for the isolation and treatment of cases. The necessary supplies and apparatus for the improvement of the plague laboratory at Honokaa, Hawaii, were loaned to the Territorial Board of Health by the Army. Two Army laboratory technicians were assigned to institute the necessary bacteriological work under the direction of the County Health Officer. <sup>11</sup> The services of an Army pathologist were provided to accomplish the necessary autopsies. In addition to this assistance, the Army has provided 50 gallons of dimethyl phthalate and 2000 two-ounce cans of insecticide powder for the protection of personnel working on the plague control program in the endemic area.

The Army has provided additional personnel for the operation of plague laboratories on the Islands of Oahu and Kauai. The purpose of these laboratories has been to examine all rodents brought in for evidence of plague infection. Many thousands of rodents have been examined, but none have been found infected with plague on these islands. On Oahu, the Army has provided one enlisted technician, and on Kauai, one pathologist and two technicians, part time.

An Army rat trapping crew has been provided for the necessary assistance to the Territorial Board of Health in a rat control program for Honolulu Harbor. This crew consisted of four enlisted men from October 1943, through April of 1944. In May 1944, the crew was increased to ten enlisted men. This service has been continued

up through September 1945.

The history of the dengue epidemic in the City of Honolulu has been fully described in CPBC ETMD reports to The Surgeon General. A program was jointly set up by the Territorial Board of Health, the Honolulu Chamber of Commerce, the U. S. Public Health Service, and the Army. For most of the period of the epidemic, one epidemiologist visited and conversed with all reported civilian and military cases. Often whole neighborhoods of unreported cases were discovered through the exchange of information between patients and the epidemiologist or visiting nurses. In the majority of cases the source of infection could be guessed with some accuracy. Usually the source of infection was outside the home premises, in one of the known foci of dengue infected mosquitoes in Honolulu. Information on several cases in a neighborhood often lead to the discovery of foci of dengue in neighborhood stores and the discovery of cases in the storekeepers' families. All this information was reported to the mosquito control organization, and intensive breeding surveys and disinsectizations were accomplished in accordance with the epidemiological leads.

Army nurses played a large role in the control program, substituting for the overworked public health nurses in almost all home visits to dengue patients. These nurses contributed materially to the working out of the epidemiologic picture. In revisiting the patients during convalescence the nurses were able to complete the individual case records upon which statistical data concerning the duration of disease, symptoms and signs were compiled.

Dengue fever had broken out so explosively in Honolulu despite considerable control effort, there was continued concern in 1943-44 that it would spread to other towns and villages. During the latter part of November 1943, three cases of dengue occurred in the town of Wahiawa, Oahu. The source of infection of these cases was probably Honolulu, nevertheless it appeared possible that secondary foci would be set up. A regular Aedes control program was established for Wahiawa in November 1943, continuing through March 1945. Wahiawa was considered especially important to the Army because of the large numbers of military personnel frequenting the town from Schofield Barracks. No definite secondary foci of infection have ever occurred in Wahiawa, despite a considerable number of imported cases from Honolulu. It is not clear what factors operated to prevent this. Temperatures frequently drop below 70°F in Wahiawa during the night. This may have been a factor. One secondary focus did occur on Kauai. Three or four secondary cases of dengue occurred in the area of Eleele-Hanapepe-Pt. Allen, Kauai, during November and December 1943. Vigorous breeding control measures and



spraying of insecticide in infected neighborhoods resulted in an end of new cases. All travelers to the other Hawaiian Islands from Oahu were educated by the airlines as to their responsibility in preventing the spread of dengue virus. In early 1943, the Air Corps began setting up camps on Kauai, Maui, and Hawaii as well as Oahu, for the recuperation of combat fliers. Many of these fliers were returning by air travel from the Gilbert Islands where dengue was epidemic. The possible effect of the arrival of these airmen on the various islands appeared to be of more concern in the spreading of the dengue virus to susceptible mosquito and human populations than civilian travel. With the arrival on Oahu of three colored medical sanitary companies in February 1943, it became possible to extend the Aedes control program to all of rural Oahu and to Kauai, Maui, and Hawaii. Two of these companies were trained in Aedes mosquito control by officers of the U. S. Public Health Service working with the Territorial Board of Health on dengue control (the third company was trained in rodent control by the Surgeon, Hq USAFICPA, for rodent control on military posts and piers). After a sufficient amount of class-work, the Aedes control personnel were given practical training by assigning a few of them to each of the Honolulu Aedes control inspectors for several days of routine inspecting. Before being sent to another island, Aedes control personnel were assigned to work an area in rural Oahu for a week's period, where their work was carefully supervised. The one disadvantage to the use of the sanitary company personnel in Aedes mosquito control work has been their color. This has been in no way connected to any inadequacy in the quality of their work, but solely because Aedes control inspectors must usually meet the lady of each house and enter the house to inspect for interior breeders (statistics show that one-quarter of all Aedes breeding places are inside dwellings). There has been a certain amount of prejudice against and fear of negroes even in the Hawaiian Islands. Nevertheless, these troops proceeded with their work without too much complaint, except on the Island of Maui. On Maui there was sufficient complaint by civilians for the Commanding General of the Maui District to order the program discontinued in July 1943. Except for the one small secondary focus of infection on Kauai, no other foci occurred outside Oahu. There was a case in the City of Hilo which was imported from Oahu, and vigorous prophylactic measures were taken in the neighborhood, including a careful survey of all Hilo for Aedes breeders. Six cases of dengue were reported from Hana, Maui, but careful appraisal resulted in the decision that they were cases of simple nasopharyngitis.

As the original medical sanitary companies have been assigned to combat missions, other companies have been received

from the mainland and trained to continue the work, however, the number of companies available for use in the Hawaiian Islands has gradually declined. The Aedes control program on Hawaii, which was begun during March 1944, was discontinued during September 1944. The program on Kauai, which was begun late in March 1944, was discontinued during November 1944. The program in rural Oahu has been continued up through September 1945.

Some of the contributions of the Army to the dengue and Aedes control efforts were as follows:<sup>12</sup>

1. In August 1943, five enlisted mosquito control technicians and three (3) Chemical Warfare Service decontamination trucks and their crews for a week's period.
2. In September 1943, fifty (50) additional enlisted personnel for Aedes mosquito control inspections.
3. From September 1943, until April 1944, the services of a medical officer as epidemiologist.
4. In October 1943, additional enlisted personnel and 14 light trucks. A smaller number of trucks had been loaned beginning in September.
5. In November 1943, additional enlisted personnel to a total of 68.
6. Beginning in November 1943, 6 Army nurses. Nurses were relieved from duty with the Board of Health in proportion to the decline in dengue cases. One nurse remained until January 1945.
7. In December 1943, additional enlisted personnel to a total of 86.
8. For the year, 1944, enlisted personnel as follows:



<u>Period</u>	<u>Honolulu</u>	<u>Rural</u> <u>Oahu</u>	<u>Kauai</u>	<u>Maui</u>	<u>Hawaii</u>	<u>Total</u>
(a) 1-15 January 1944	95					95
(b) 15-31 January "	95					95
(c) 1-15 February "	99					99
(d) 15-29 February "	99					99
(e) 1-15 March "	78					78
(f) 15-31 March "	146	58	41	43	57	345
(g) 1-15 April "	146	58	41	43	57	345
(h) 15-30 April "	132	58	41	43	57	331
(i) 1-15 May "	140	58	41	43	57	339
(j) 15-31 May "	148	58	41	43	57	347
(k) 1-15 June "	148	58	41	43	57	347
(l) 15-30 June "	90	58	41	43	57	289
(m) 1-31 July "	85	63	41	43	57	288
(n) 1-31 August "	85	109	41	0	57	292
(o) 1-30 September "	84	77	40		57	258
(p) 1-31 October "	77	77	40			194
(q) 1-30 November "	77	77	40			194
(r) 1-31 December "	74	77				151

9. For the year 1945, enlisted personnel have been as follows:

<u>Period</u>	<u>Honolulu</u>	<u>Rural</u> <u>Oahu</u>	<u>Total</u>
(a) January 1945	79	44	123
(b) February 1945	78	4	82
(c) March "	77	46	123
(d) April "	69		69
(e) May "	67	60	127
(f) June "	65	60	125
(g) July "	64	60	124
(h) August "	70	60	130

Until August 1944, all military personnel on duty with the Territorial Board of Health to carry out the Aedes control program had all been made available on detached service from various Medical Department units on an emergency basis. These Medical Department units had their respective missions to perform and were handicapped by the absence of the large numbers of personnel on detached service. The Board of Health had made every effort to recruit civilian personnel to replace the military Aedes control inspectors, but without success. In January 1944, the Commanding

General, USAFICPA, had requested authorization from the War Department to form a special sanitary battalion of Army personnel to support the Territorial Board of Health.<sup>13</sup> A proposed T/O & E for this special sanitary battalion was attached to the letter of request. The battalion provided an organization to which the Army enlisted personnel already on duty with the Territorial Board of Health as sanitary and dengue inspectors could be assigned. It also provided additional personnel for rodent control and expansion of the Aedes control program for rural Oahu, and the Islands of Hawaii, Maui, and Kauai. The need for an extensive Aedes mosquito control program had been the subject of numerous letters between the Commanding General, USAFICPA, and the Assistant Secretary of War, particularly in connection with the possible use by the enemy of yellow fever as an offensive weapon.<sup>14 15 16</sup> In October 1943, the United States Public Health Service, District No. 10, Territory of Hawaii, was set up. It was the plan of the War Department that the Senior Surgeons assigned thereto could achieve a solution to the problems of mosquito and rodent control in the Territory.<sup>17</sup> Decision as to further action of the War Department was deferred pending study of the problems in the Territory by the newly appointed Director, United States Public Health Service, District No. 10.<sup>18</sup> Report of these studies was submitted 1 January 1944,<sup>19</sup> including outlines of proposed programs for mosquito and rodent control. It was stated by the Director, USPHS District of Hawaii, that "in neither case, however, has it appeared even remotely possible that these expanded programs can be operated by the Territorial Board of Health through assistance now available from the Public Health Service, since personnel for the operation of the programs are not available in the Territory through civilian employment channels."<sup>19</sup> Nevertheless, the request for a special sanitary battalion made by the Commanding General, USAFICPA, in his letter to the Adjutant General, dated 1 January 1944, was disapproved by 1st indorsement thereto, dated 2 February 1944, with the advice that further investigation be made into the possibilities of procurement from civilian sources on the mainland of the required labor to support the proposed program. It is believed that every effort was made by the Territorial Board of Health with the assistance of the United States Public Health Service to obtain civilian personnel for this work, however, it has been necessary for the Army to continue to provide personnel for the continuation of the Aedes control program. The problem of continuing Army support to the Territorial Board of Health for sanitation and Aedes control in Honolulu was solved in August, 1944, with the activation of the 114th Medical Service Company.<sup>20 21</sup> Personnel so long on detached service from Medical Department units of the theater for the purpose of carrying on this work were absorbed by the T/O of the 114th Medical Service Company.

The Public Health Committee of the Chamber of Commerce of Honolulu is an active public agency in the Territory, controlling



considerable funds for the support of worth while measures for the betterment of health. These funds result from a voluntary tax collected on a tonnage basis from all vessels using Honolulu Harbor. A representative of the Hawaiian Department Surgeon has worked closely with this committee since 1942. In 1944, the Honolulu Chamber of Commerce began to foster committees for the study of problems of post-war health planning. At the request of the Chamber of Commerce a representative of the Surgeon, CPBC, was appointed as a member of two subcommittees, the subcommittee on Mosquito Control and the subcommittee on Rodent Control of the Post-War Planning Committee of the Chamber of Commerce.<sup>22</sup> As a result of the work of the subcommittee on Mosquito Control a plan was drawn up for a post war Aedes control organization for the Territory, this organization to be entirely supported and operated on a civilian basis and to relieve the Army supported organization. According to this plan the Aedes control organization would operate as a separate division of the Bureau of Sanitation of the Territorial Board of Health on a biennium budget of \$268,056.00.<sup>23</sup> The major Aedes control activity would take place in Honolulu, with a small program in Hilo. It was considered that these cities would be the most likely points of entry of Aedes-borne diseases into the Territory. According to the plan, the Honolulu organization would serve as a mobile force to proceed to any area in the Territory and set up prompt Aedes control measures, wherever necessary. It is expected that this plan will be presented to the Civil Governor of the Territory during early October 1945, with the hope that it will receive his support through a large Contingency Fund under his control. The next meeting of the Territorial Legislature will take place in 1947. The presentation of this plan to the Civil Governor is timely, since the Army will probably be unable to provide Army personnel for Aedes control in Honolulu very much longer with the radical reduction in critical point discharge scores. The new plan provides for only 23 inspectors with additional foremen, but it is expected that certain new Aedes control techniques involving the use of DDT, developed during the present program, will allow considerable saving in manpower.<sup>24</sup>

In January 1944, the Surgeon, Headquarters USAFICPA, brought to the attention of the Commanding General the existence of a number of grossly insanitary rooming houses in the City of Honolulu which were serving Army and Navy enlisted personnel on pass. Sanitary inspections of these establishments showed crowding of cots tightly against one another in basements, the use of cots by two men, the provision of soiled bed linen, bedbug and cockroach infestation, and filthy surroundings and toilet facilities. High prices for the overnight rental of such facilities prevailed, due to

the scarcity of accommodations in Honolulu. Similar action was taken by the Surgeon, 14th Naval District, in notifying the Commandant, 14th Naval District. Complaint was made of these conditions in an exchange of correspondence between the Commanding General, USAFICPA, and the Civil Governor of Hawaii in February, 1944, in which it was noted that the Territorial Board of Health was taking action to correct the deficiencies.<sup>25</sup> It was reported by the Military Police that even with all of the established recreation facilities such as Army Navy YMCA, The Recreation Center at Fort DeRussy, and the USO Club on King Street in Honolulu, plus the insanitary tenements, many enlisted men walked the streets or slept on porches for want of accommodations. To meet this need the Army, in May 1944, opened a hotel for enlisted men in Honolulu sufficient for the accommodation of 325 men.<sup>26</sup> Further action in connection with the tenements was not taken by the Army. The Navy established a continuous program of inspection of these places by the Shore Patrol and published lists of approved and disapproved establishments for the guidance of Navy personnel. In 1945, the Navy arranged with the United States Public Health Service, District of Hawaii, for the spraying of certain of the approved establishments with DDT spray as a protection against bedbugs. It was the opinion of a sanitary officer of the Navy that the program of surveillance of these establishments by the Shore Patrol was of definite benefit to Navy personnel and of some assistance to the Navy venereal disease officer.

A Joint Army-Navy Disciplinary Control Board was established in Honolulu in February 1945. The original members of the board were appointed by SO 37, HQ USAFPOA, 6 February 1945.<sup>27</sup> The first meeting of the board was held on 14 February 1945. The investigations leading to complaints considered by the Board were carried out by various different agencies. The military police furnished a large share of the evidence on prostitution and on exorbitant prices charged by amusement centers and concessionaries. A Joint Board investigating team was set up to inspect restaurants, tattoo parlors, barber shops and other establishments where sanitary inspections were considered necessary. The investigating team consisted of a sanitary officer from the 14th Naval District Medical Office, a medical officer from the Medical Inspector's Section of the Surgeon's Office, CPBC, and the Supervisor for Sanitation for the Island of Oahu of the Territorial Board of Health. Several meetings of the board were held to plan a course of action. It was felt that the most pressing need was to bring prices in line in amusement areas and to suppress clandestine prostitution. After investigation by military personnel, the Board recommended and the Commanding General, USAFPOA, and the Commander in Chief, POA, placed 37 Amusement Centers and 15 hotels and rooming houses off limits as of noon, 3 March 1945. This move caused considerable comment in the local press, and news stories, editorials and letters



to the editor were published. The Territorial legislature was in session at the time and proposals were introduced upon the floor to investigate the cause of the action by the military. Several protest meetings were held by the owners of the affected establishments. The desired clean-up and lowering of prices was obtained fairly rapidly. Establishments were placed back on limits after the board had satisfied itself, generally by personal inspection, that reasonable prices had been established in amusement centers, and that adequate supervision was present to suppress prostitution in rooming houses. Shortly after this, a campaign to clean up the restaurants and eating places frequented by military personnel was started. The investigation team visited each restaurant referred by the Territorial Board of Health or other sources as insanitary and inspected it. Deficiencies were pointed out to the owner orally, and the request made that the deficiencies be remedied. Most owners were willing to close up and clean up. Some were uncooperative, in which case a report was made to the Joint Board. The Board then recommended that the establishment be placed "off limits". In the meantime, the Board of Health wrote a letter to the owner of the uncooperative establishment citing deficiencies and requiring them to be corrected. After an establishment had met Board of Health requirements, and was operating for civilians, it was again inspected by the joint team. If the sanitary conditions were satisfactory, the recommendation was made by the team to the Disciplinary Board that the establishment be again placed on limits. The Board then recommended to the Commanding General, USAFPOA, and Commander in Chief that the establishment be placed on limits. The Joint Team also inspected installations selling foodstuffs, mainly baked goods, to the Services. Standards were set up for tattoo parlors, and excellent cooperation was obtained. No attempt was made to clean up barber shops. The Board of Health has no sanitary regulations for them.





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
August 1945

I. Monthly Summary

A. Dengue Fever Cases--Non-military

Cases acquired within Territory	0
Cases "off-shipping"	0

B. Control Program--Territory-wide (as covered in this report)

No. of premises inspected	58,917
No. of premises breeding <u>Aedes</u>	1,022
Total personnel engaged in program	165

News of the definite conclusions of war with Japan did not materially affect the program except for a loss of man-days. It is expected that the program will be continued on the present scale until the major redeployment of troops in the Pacific has been completed.

II. Control Activities in Honolulu

A. Inspection Activities

The city-wide Aedes breeding index in Honolulu was 1.7% on August 15 and 1.2% on August 31. At the end of August, 3 zones had indexes above 5% and 7 zones had indexes above 3%.

The Aedes breeding indexes for the 20 critical zones vary as follows: (Zone 25D was dropped from critical zone list.)

0.0% - 0.5% --	12
0.6 - 1.0 --	4
1.1 - 1.5 --	4

Following is a summary of the August inspection activities:

No. of premises inspected	45,695
No. of premises breeding <u>Aedes</u>	641
<u>Aedes</u> breeding index on August 31	1.2%
No. of inspections per man-day	45.1

## B. Special Work

### 1. Larviciding Activities

#### a. Motorcycle larviciding unit

The following mosquito breeding places were sprayed with 317 gallons of diesel oil with the motorcycle larviciding unit:

catch basins and storm drains	1,940
ground pools	45
cesspools	4
ditches and streams	16
swamps	4
bomb shelters	2
pillboxes	2
fishponds	2

#### b. Larviciding by inspection foreman

The following mosquito control places were larvicided with 36 gallons of diesel oil by the inspection foreman during August:

catch basins and storm drains	8
ground pools	22
cesspools	4
ditches and streams	1
fishponds	2

#### c. Power larviciding

The Power Sprayer was used to larvicide Pauoa and Pukoi streams. Ninety-five gallons of diesel oil were used.

Two new Hardie power-spraying units were received from Malaria Control in War Areas, Atlanta, Georgia. These units are expected to make the power larviciding activities more efficient and dependable.

### 2. Clean-up Activities

The clean-up detail from the 760th Medical Sanitary Co. continued to cover certain sections of the city on a house-to-house basis collecting all tin cans, bottles, and other potential breeding containers. In carrying out this activity, 192 man-days work were expended and 64 loads of containers were removed from the areas covered.



In addition to the above clean-up activities, 13 loads of containers were removed from premises in abating 18 referral slips. 117 old tires were collected for disposal.

### 3. Special Activities

#### a. Fish stocking

7 fishponds were stocked with mosquito fish

#### b. Roof gutters

7 roof gutters were cleaned and repaired

#### c. Inspection of USED Base Yards and Waterfront Areas.

Records of regular inspections of USED Base Yards and Waterfront areas were lost when the regular inspector was transferred.

The Surgeon's Office of the Army Port and Service Command responsible for mosquito breeding in the USED Base Yards received a considerable amount of DDT. Assistance and instructions have been provided by this office for the most practical use of DDT in the Base Yards. Present operations call for the spraying of all stored equipment and places where water might collect, with 5% DDT kerosene spray. Only that equipment which cannot be restacked so it will not hold water is being treated. All tarpaulins used to cover equipment are being treated also. At least, .2 of a gram of DDT is applied per square foot of area treated. During August, 3 Base Yards were covered using 30 gallons of the DDT spray.

#### d. Rock-hole and tree-hole filling

During the month of August, 118 rock-holes and tree-holes were filled with cement.

### C. Cooperative Program with the Board of Health, Bureau of Sanitation, Sanitary Inspection Division.

During the month of August, 85 referrals were submitted covering sanitary defects noted by the mosquito control inspectors to the Bureau of Sanitation, Inspection Division, for abatement. During August, 72 referrals were abated by the Sanitation Division. Inasmuch as the Board of Health has lost many of its sanitary inspectors, the back-log of referrals submitted to be corrected has increased.

#### D. Drainage Improvement.

At our instigation, the City and County of Honolulu Road Department constructed an 18 inch drain in 700 feet along Makini Street to Campbell Avenue. Previously, a natural storm-drain from Diamond Head flowed across a city block from Makini St. creating a prolific Culex breeding spot. While this was normally a dry run, weekly drainage from the Ft. Ruger swimming pool maintained a continuous problem.

E. Personnel	<u>Field</u>	<u>Total</u>
Army (Average)	67	70
U.S. Public Health Service	21	30
Total	<u>88</u>	<u>100</u>

During the past three months, there has been a considerable turnover in the ranks of the Army personnel assigned to the Honolulu program. During this period, 34 men were lost and 33 gained with 23 lost during August and 29 gained in August. These were given complete technical and field training. Of the number of men lost, three were supervisors; six, foremen; and four, assistant foremen.

#### III Rural Oahu

##### Personnel--60

Inspection activities were continued in rural Oahu by the detachment assigned to the Dengue Mosquito Control Program from the 760th Medical Sanitary Company. As noted under the clean-up activities of the Honolulu program, 192 man-days were expended by the clean-up detachment in Honolulu. The following is the summary of the inspection activities for the period July 16-31 and the month of August.

July 16-31, 1945	No.	Prem.	Aedes	Man-Days
<u>Town</u>	<u>Prem.</u>	<u>Breed.</u>	<u>Breed.</u>	<u>in</u>
	<u>Insp.</u>	<u>Aedes</u>	<u>Index</u>	<u>Field</u>
Aiea	506	1	0.1	19.0
Ewa	1,078	15	1.3	28.5
Haleiwa	201	4	1.9	8.0
Kailua	328	4	1.2	11.0
Kaneohe	229	7	3.0	10.0
Lanikai	246	2	0.8	6.0
Pearl City	283	5	1.7	10.5
Wahiawa	1,939	16	0.8	51.5
Waialua				
Waimanalo	185	1	0.5	5.0
Waipahu	1,399	4	0.2	50.0
Totals	<u>6,394</u>	<u>59</u>	<u>---</u>	<u>199.5</u>



August 1-31, 1945

<u>Town</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Man-Days</u> <u>in</u> <u>Field</u>
Aiea	1,285	4	0.3	46.5
Ewa	1,244	6	0.5	33.0
Haleiwa	642	3	0.5	23.5
Kailua	622	6	1.0	22.0
Kaneohe	415	12	2.9	23.0
Lanikai	466	3	0.6	11.0
Pearl City	539	12	2.2	21.0
Wahiawa	1,539	13	0.8	41.0
Waialua	1,818	6	0.3	52.0
Waimanalo	376	3	0.8	12.0
Waipahu	1,444	12	0.8	45.0
Totals	10,390	80	—	330.0

#### IV. Hilo, Hawaii Program

Personnel—5

Regular control activities on the Hilo Program are tabulated as follows for the month of August:

No. of premises inspected	2,832
No. of premises breeding <u>Aedes</u>	301
<u>Aedes</u> breeding index on July 31	10.6%
<u>Culex</u> breeding index	1.7%
No. of containers inspected	11,594
No. of containers breeding <u>Aedes</u>	671
General container <u>Aedes</u> breeding index	5.8%

#### V. Public Education

##### A. School Program

Conferences were held with the Department of Public Instruction Health Section on the preparation of material for mosquito lectures by the Public School System.

##### B. News Releases

During the month 7 column inches of English and 4 column inches of foreign language news articles appeared in local papers.

## VI. Entomological Work

### A. Light traps mosquito collections

The report from the quarantine officer covering the use of the five light traps on loan from Malaria Control in War Areas for the month of July was received. Traps were located at the Kalihi Leprosy Investigations Laboratory, Ekahanui Gulch, Kaneohe, Ewa Air Station, and Hickam Field. In all areas, a consistent catch of Culex quinquefasciatus was made.

- B. A field trip was made by the Assistant Sanitarian (R), David D. Bonnet, on Wednesday, August 27, with Major Webb of the 18th Medical General Laboratory and Capt. Wirth, USPHS Quarantine Division to Mt. Kaala, the highest mountain on the Island of Oahu. This mountain rises to an elevation of 4,040 feet and has a large amount of standing water in the ancient crater near the summit. No adult mosquitoes or mosquito breeding was observed at this elevation, and it is doubtful that the three species found in the Territory of Hawaii ever ranged to that altitude.

- C. The mosquito control laboratory at the request of Surgeon's Office, CPBC, has undertaken to provide larval and adult Aedes aegypti and Aedes Albopictus to the entomological section of the 18th Medical General Laboratory, POA, under Major Webb for starting cultures and experimental purposes.

### D. Routine Activities

1. Approximately 650 mosquito larvae samples collected by the inspectors on the program were examined and identified.
2. Approximately 25,000 phenothiazine strips were prepared during the month.

Respectfully submitted,

/s/ Arve H. Dahl  
Arve H. Dahl  
P. A. Sanitary Engineer (R)  
i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
July 1945

I. Annual Summary for 1944-1945 Fiscal Year

During the 1944-1945 fiscal year the Dengue Mosquito Control Program in the Hawaiian Islands was continued to maintain a safe Aedes mosquito population to prevent a recurrence of the 1943 epidemic. Sporadic cases of dengue fever were reported throughout the year, all occurring in Honolulu. However, due to the low Aedes aegypti and Aedes albopictus populations, no general outbreak occurred.

The following statistics have been summarized for the year:

No. of dengue cases	25
Total no. of premises inspected	922,778
Total no. of premises breeding <u>Aedes</u>	11,238
Total no. of tree holes filled	17,325
Total no. of rock holes filled	5,343
Total no. of truck loads hauled by cleanup crews	661

II. Monthly Summary

A. Dengue Fever Cases--Non-military

Cases acquired within Territory	1
Cases "off-shipping"	0

B. Control Program--Territory-wide (as covered in this report)

No. of premises inspected	51,068
No. of premises breeding <u>Aedes</u>	878
Total personnel engaged in program	158

III. Control Activities in Honolulu

A. Inspection Activities

The city-wide Aedes breeding index in Honolulu was 1.1% on July 15 and 1.1% on July 31. At the end of July, 4 zones had indexes above 5% and 7 zones had indexes above 3%.

The Aedes breeding indexes for the 21 critical zones vary as follows:

0.0%	-	0.5%	--	11
0.6	-	1.0	--	5
1.1	-	1.9	--	5

Following is a summary of the inspection activities:

No. of premises inspected	45,523
No. of premises breeding <u>Aedes</u>	507
<u>Aedes</u> breeding index on July 31	1.1%
No. of inspections per man-day	41.8

B. Special Work

1. Larviciding Activities

a. Motorcycle larviciding unit

The following mosquito breeding places were sprayed with diesel oil with the motorcycle larviciding unit:

catch basins and storm drains	1,906
ground pools	48
cesspools	8
ditches and streams	19
swamps	6
bomb shelters	4
pillboxes	2
fishponds	3

A total of 425 gallons of diesel oil was used in these larviciding activities. Any body of standing water is referred by the inspectors to this larviciding unit. This unit then takes care of this referral until the problem is corrected and needs no further larviciding. Until correction is made, visits are made every 12 days.

b. Power larviciding

The Power Sprayer was used to larvicide the Oili Rd. ditch, Sheridan St. ditch and the Akolea Rd. ditch twice during the month. 100 gallons of diesel oil were used.

2. Adult Spraying Activities

Only premises around the one reported case of dengue were sprayed using Sure-shot sprayers containing Pyrocid 20 propelled by Freon gas.

3. Clean-up Activities

The clean-up detail from the 760th Medical Sanitary Company was used to cover certain sections of zones which have been showing an increase in breeding. They have covered these areas on a house-to-house canvass collecting all tin cans, bottles and other potential breeding containers. In carrying out this activity, 440 man-days were expended and 89 loads of containers were removed from the areas so covered.



In addition to the above clean-up, 27 loads of containers were removed from premises in abating 30 referral slips. There are still a great number of old tires in the city of Honolulu and during the month of July, 134 were collected and disposed of.

#### 4. Special Activities

##### a. Fish stocking

One fishpond was stocked with fish

##### b. Roof gutters

Six roof gutters were cleaned and repaired

##### c. Inspection of USED base yards and waterfront area

Complete inspection of 58 USED base yards were made. Aedes breeding was found in five yards. 38 complete inspections were made in the waterfront area and no mosquito breeding was found.

Two medical corpsmen assigned to the Surgeon's Office of the USED were given training in AEDES mosquito control with special emphasis on methods and procedures used in covering the USED base yards.

##### d. New warehouse

A prefabricated building, 16' x 40', was received from the U.S. Army for use by the Dengue Mosquito Control Program. This building was set up on the property of the Territorial Board of Health garage. It will be used as a storage warehouse and special crew operations center. A total of 22 man-days were expended in erecting this warehouse and preparing it for operations.

#### C. Co-operative Program with the Board of Health, Bureau of Sanitation, Sanitary Inspection Division

Under this co-operative program 407 referrals have been submitted since the program was started to the Bureau of Sanitation Inspection Division. Approximately 50% of these have been abated. This figure is considered quite satisfactory inasmuch as there is a lag of approximately 3 to 6 weeks in obtaining correction of the referrals.

#### D. Court Case on Mosquito Control

The first court case solely on a violation of mosquito control ordinance, Section 73 of the Rules and Regulations of the Board of Health, Territory of Hawaii, occurred in July. The offense

was based upon the establishment of an Aedes mosquito breeding place by improper construction of an ice storage house. Water drained through the floor and collected in a pool in which Aedes mosquitoes bred. In addition to the above offense, six other instances where Aedes mosquito breeding was found on the violator's premises were used as evidence. These instances were recorded upon the householder notices of which a copy is kept on file and served as court evidence. The fine imposed by the court consisted of \$25.00 and 15 day sentence suspended for 13 months with orders to clean-up his premises immediately.

#### E. Elimination of Mosquito Breeding on the Waialae Golf Course

For some time a normally dry run, Kapakahi Stream, has been a running stream due to effluents from many hog farms. The effluent ponded along the flat dry run providing excellent habitat for the breeding of Culex quinquefasciatus. A meeting was held June 28 with 26 hog farmers of the Kapakahi district at which methods of proper disposal of their wastes were discussed. The methods recommended involved the use of their pig-pen washings for irrigation purposes in the field each farmer maintained for the growing of fresh grass for his animals. Two methods used were (1) main ditches with laterals and (2), contour ditches 2-1/2 feet deep. Mosquito breeding on the premises is controlled by the great amount of lime spread upon the ground and in the water to keep down odors and fly breeding.

#### F. Personnel

	<u>Field</u>	<u>Total</u>
Army	61	64
U.S. Public Health Service	20	29
TOTAL	81	93

#### IV. Rural Oahu

##### Personnel--60

Inspection activities were continued in rural Oahu by the detachment assigned to the Dengue Mosquito Control Program from the 760th Medical Sanitary Company. Following is a summary of the inspection activities for the first 15 days of July. (A report on activities for the period July 16-31 has not been tabulated in time for this report.)



<u>Town</u>	<u>No. Prem. Insp.</u>	<u>Prem. Breed. Aedes</u>	<u>Aedes Breed. Index</u>	<u>Man-Days in Field</u>
Aiea	436	9	2.0	15
Haleiwa	211	4	1.8	9.5
Kailua	366	5	1.3	13.0
Kaneohe	209	8	3.8	11.0
Lanikai	243	1	0.4	6.0
Pearl City	319	7	2.1	9.5
Waialua	443	2	0.4	11.5
Waimanalo	191	3	1.5	4.0
	<u>2,418</u>	<u>39</u>		<u>79.5</u>

In addition to the above activities, the clean-up crew which is a part of the entire detachment was used on the Honolulu Program.

#### V. Hilo, Hawaii Program

Personnel--5

Regular control activities on the Hilo Program are tabulated as follows for the month of July:

No. of premises inspected	3,127
No. of premises breeding Aedes	362
Aedes breeding index on July 31	11.6%
No. of premises breeding Culex	0
Culex breeding index	0%
No. of containers inspected	18,782
No. of containers breeding Aedes	828
General containers Aedes breeding index	4.9%
No. of inspections per man-day	41.1%

In addition to the regular inspection activities, 107 rock and tree holes were permanently corrected by filling and 3 ground pools were filled with sand.

#### VI. Public Education

##### A. School Program

Since all schools in the Territory of Hawaii closed during June there is no monthly report covering this activity. Discussions are being carried on with the Department of Public Instruction to determine what course this activity shall take during the next school year.

In reviewing the program for the past fiscal year, it is significant to note the amount of work in the schools participating in this program. Students in 49 schools on the Island of Hawaii and 21 schools on the Island of Maui participated. The following is a summary of all the inspections made during the year by the students:

	<u>Hawaii</u>	<u>Maui</u>
No. of students reporting	66,268	23,054
No. of wet containers found	143,206	35,984
No. of containers with wrigglers	47,820	8,269

#### B. News Releases

During the month 10 column inches of English and 5 column inches of foreign language news articles appeared in local papers.

### VII. Entomological Work

#### A. DDT Investigations

##### Control of Aedes Breeding in Vine Bowls

One test not previously reported consisted of the addition of 1 cc of 1-1/2% DDT in 95% Ethyl alcohol which was added to one pint of water in a vine bowl. This is equivalent to a dosage 5 times that which has been recommended by laboratory experiment. The only treatment occurred on March 1 and the vine bowl has been periodically tested to determine the residual kill of Aedes albopictus fourth instar larvae. On March 27, April 3, April 11, April 20, May 11, June 1 and June 11 the larvae were killed within 24 hours. On July 20 the vine bowl did not kill introduced larvae. This is a residual period of approximately 20 weeks. The test was not primarily to determine the residual time but to observe the effect upon the Philodendron plant growing in the vine bowl. The plant continued to grow and showed no different growth than did the control which was kept under the same conditions without DDT. The control plant was tested simultaneously with the experimental container and in each of the above-mentioned dates the larvae remained alive.

#### B. Routine Activities

1. Approximately 500 mosquito larvae samples collected by the inspectors on the program were examined and identified.
2. Approximately 54,000 phenothiazine strips were prepared during the month.

Respectfully Submitted,

/s/ Arve H. Dahl

Arve H. Dahl

P.A. Sanitary Engineer (R)

i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
June 1945

I. Monthly Summary

A. Dengue Fever Cases--Non-Military

Cases acquired within Territory--7  
Cases "off-shipping"--0

B. Control Program--Territorywide (As covered in this report)

No. of premises inspected	52,392
No. of premises breeding <u>Aedes</u>	921
Total personnel engaged in program	156

C. School Program

The June report from the County Health Officer on the Island of Hawaii and the May and June reports from the Acting Health Officer on the Island of Maui covering the school mosquito control program are summarized as follows:

No. of students reporting	16,268
No. of wet containers found	25,687
No. of containers with wrigglers	7,075

Details of these reports will be found under V, Public Education, of this report.

II. Control Activities in Honolulu

P. A. Sanitarian (R) Bertram Cross, who was formerly supervisor of the Honolulu program, has been transferred to the position of Acting Health Officer of the Island of Kauai as of June 2, 1945. The duties formerly performed by Mr. Cross will be handled by P. A. Sanitary Engineer (R) Arve H. Dahl assisted by Assistant Sanitarian (R) David D. Bonnet.

Seven more positive cases of dengue were reported during the month of June in Honolulu. Special inspectional and adult spraying precautions as noted in the May narrative report were continued.

Complicating the dengue picture was the occurrence of a flu epidemic in which a good many of the symptoms have been similar to those of dengue. Inasmuch as some dengue cases may have been reported as flu, spray activities have been continued wherever adult Aedes mosquitoes have been found. The last two positive cases were reported on the 14th and 17th of June.

#### A. Inspection Activities

The citywide Aedes breeding index in Honolulu was 1.4% on June 15 and 1.3% on June 30. At the end of June, 3 zones had indexes above 5% and 9 zones had indexes above 3%.

Zones 25-D and 25-E were added to the list of critical zones inasmuch as one of the positive cases of dengue occurred in Zone 25-E and many military personnel frequent these two zones. The Aedes breeding indexes for the 21 critical zones varied as follows:

0.0%	-	0.5%	--	7
0.6	-	1.0	---	8
1.1	-	1.9	---	5
		4.5	--	1

Following is a summary of the inspection activities:

No. of premises inspected	44,850
No. of premises breeding <u>Aedes</u>	619
<u>Aedes</u> breeding index on June 30	1.3%
No. of inspections per man-day	41.3

#### B. Special Work

##### 1. Larviciding Activities

A change was made during the month of June in the method of handling larvicidal problems. The checking and oiling of all places requiring regular larviciding were put on the list to be handled by the motorcycle larviciding unit. The following mosquito breeding places were sprayed with diesel oil with this unit:

catch basins---	746
ground pools---	30
cesspools---	22
ditches and streams---	14
swamps--	3
bomb shelters---	1
pillbox---	1

A total of 270 gallons of diesel oil was used in all larviciding activities.



The motorcycle Servi-car which has been used up to this time on the program broke down beyond repair during the month. The temporary loan of a machine was made from the U. S. Coast Guard. It is hoped that a permanent replacement can be made of the old unit within the next two months.

## 2. Adult Spray Activities

Special emphasis was placed on the activity in order to minimize the danger of possible secondary cases of dengue. Pyrethrum sprays have been used almost exclusively for this work.

### a. Outdoor spraying

A total of 338 premises were sprayed, using 400 gallons of pyrethrum emulsion spray. The Hardie orchard type sprayer was used for this work.

### b. Inside spraying

Approximately 100 homes were sprayed with sure-shots using Pyroicide 20 propelled by Freon gas. One school containing 92 rooms, and 2 theaters containing 722 and 1,087 seats respectively, were also sprayed, using Pyroicide 20 diluted with 3 parts of kerosene using an atomizing nozzle and a power sprayer.

## 3. Clean-up Activities

Due to the great number of containers placed in the cemeteries on Memorial Day, the first week in June was used to remove all temporary containers from the cemeteries. Both clean-up crews were used on this activity. A total of 37 loads of containers were removed from the 30 cemeteries taken care of. Letters were written to the caretakers in advance requesting that the containers be stacked by access roads in order that they could be picked up without delay. When the pick-up was made a special squad combed each cemetery, removing all additional temporary containers that could be found.

In addition to the above clean-up, 7 loads of containers were removed from premises in abating 14 referral slips; 13 loads of containers were removed from vacant lots.

## 4. Special Crew Activities

### a. Fish stocking

Eight fish ponds were stocked with fish.

b. Roof gutters

Thirty-two roof gutters were cleaned and repaired.

c. Inspection of USED base yards and waterfront area

Complete inspections of 30 USED base yards were made. Aedes breeding was found on 5 yards. Thirty-eight complete inspections were made in the waterfront area and no mosquito breeding was found.

C. Personnel

	<u>Field</u>	<u>Total</u>
Army	62	65
U.S. Public Health Service	<u>18</u>	<u>26</u>
Total	80	91

D. Co-operative Program with the Board of Health, Bureau of Sanitation, Sanitary Inspection Division.

Efforts have been made to coordinate the activities of the dengue mosquito control organization and the sanitation inspectors of the Board of Health. Under an agreement reached in conference with Mr. B. J. McMorrow, Director, Bureau of Sanitation and Mr. George Robertson, Division Supervisor, Oahu, a coordinated program for abating both sanitary and mosquito problems was worked out. A directive was issued by Mr. McMorrow covering this agreement. The following main points were included in his directive:

1. "Dengue mosquito control inspectors, during their premise-to-premise inspections, will observe premises for the following insanitary conditions: overflowing cesspools, improperly covered cesspools, leaking plumbing and broken sewers, heaps of garbage or rubbish on private premises and improper garbage containers at food handling establishments."
2. "Whenever one or more of these conditions is observed, the inspector will refer them to the Oahu inspection staff." This section provides for the handling of these referrals, abatement by the sanitation inspector and notification of the mosquito control section of the abatement of these nuisances. This section will include difficult problems of mosquito control which require the issuing of abatement orders by the Board of Health and provides for quicker abatement of these problems. It will assist the sanitation inspectors by minimizing the area he must travel in order to locate the common sanitary nuisances.



3. Any general complaints regarding mosquitoes shall be referred to the Officer in Charge of the dengue mosquito control.

This program has been in operation since May 1. To date a total of 242 referrals have been submitted to the sanitation inspectors, of which 145 have been abated.

### III. Rural Oahu Program

Personnel--60

Inspection activities were continued in rural Oahu by the detachment assigned to the dengue mosquito control program from the 760th Medical Sanitary Company. The following is a summary of the inspection activities:

<u>Town</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Man-Days</u> <u>in</u> <u>Field</u>
Aiea	922	17	2.8	32.0
Ewa	1368	8	.3	35.5
Haleiwa	407	10	2.3	17.5
Kailua	644	15	.9	23.0
Kaneohe	454	17	2.7	22.0
Lanikai	464	12	1.2	12.0
Pearl City	720	14	1.4	24.0
Waialua	835	10	.8	24.0
Wahiawa	2310	26	1.1	56.0
Waimanalo	375	2	--	13.0
Waipahu	1861	19	1.4	56.0
	10,360	150		315.0

The three inspectional teams have been kept at full strength by making replacements from the clean-up crew. This arrangement was made to maintain regular inspectional cycles even though several inspectors may be absent from one crew due to sickness or pass. A high caliber of work has been performed by this entire detail.

The clean-up crew removed 4 loads of containers from cemeteries in rural Oahu and took care of 4 clean-up referrals during June. The balance of the crew's time was utilized in Honolulu on similar work.

### IV. Hilo, Hawaii Program

Personnel--5

Regular control procedures on the Hilo program were inaugurated during June following the completion of the training of the 4 new inspectors.

Transportation was assigned to the unit by the County Health Officer in order to facilitate the inspectional operations. The following is a summary of the inspectional activities for the month of June:

No. of premises inspected	1,732
No. of premises breeding <u>Aedes</u>	210
<u>Aedes</u> breeding index on June 30	12.1%
No. of premises breeding <u>Culex</u>	4
<u>Culex</u> breeding index	0.20%
No. of containers inspected	7,336
No. of containers breeding <u>Aedes</u>	365
General container index	5.0%

## V. Public Education

### A. School Program

The following table is a summary of the reports from the Island of Maui for the months of May and June and for the Island of Hawaii for the month of June:

	<u>Hawaii</u> <u>June</u>	<u>May</u>	<u>Maui</u> <u>June</u>
No. of schools reporting	49	19	10
No. of students in the 4th grade and up	11,071	7,198	4,063
No. of students reporting	7,908	5,306	3,054
No. of containers found	13,869	8,008	3,810
No. of containers with wrigglers	4,664	1,626	785
Container breeding index	33.6	20.3	20.5
Container breeding index for previous month	32.0	26.4	20.3

### B. News Releases

During the month 53 column inches of English and 27 column inches of foreign language news articles appeared in local papers. It is the aim of the publicity section to have at least two articles a week on mosquito control in each of the two main Honolulu papers which receive territorywide distribution.

## VI. Entomological Work

### A. DDT Investigations

A series of 5 coca-cola bottles were treated continuously over a period of three weeks with DDT. These bottles were taken to the



local coca-cola bottling works for refilling. It was found that during the washing, sterilizing and filling process all traces of DDT were removed.

B. Routine Activities

1. Nine hundred mosquito larvae specimens from all sections of the city were examined and identified.
2. Approximately 21,500 phenothiazine strips were prepared for use in the Honolulu Control program.

C. A New Jersey light trap was placed in operation at the Kalihi laboratory during the latter part of June. This trap is approximately 3 miles from John Rogers Airport and the Naval Air Station, Honolulu. It is being operated in conjunction with the Quarantine Division of the U. S. Public Health Service.

D. An hour's talk on dengue and other insect-borne diseases in Honolulu was presented to the officers of the 18th General Medical Laboratory, U. S. Army. This talk was well received and was followed by a discussion of the general situation in Hawaii.

Respectfully Submitted,

/s/ Arve H. Dahl  
Arve H. Dahl  
P.A. Sanitary Engineer (R)  
i/c Dengue Mosquito Control





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
May 1945

I. Monthly Summary

A. Dengue Fever Cases--Non-military

Cases acquired within Territory--2

Cases "off-shipping"--0

B. Control Program--Territorywide (As covered in this report)

No. of premises inspected	54,669
No. of premises breeding <u>Aedes</u>	920
Total personnel engaged in program	161

C. School Program

The May report from the County Health Officer on the Island of Hawaii and the April report from the Acting Health Officer on the Island of Maui on the school mosquito control program are summarized as follows:

No. of students reporting	15,227
No. of wet containers found	27,522
No. of containers with wrigglers	8,257

Details of these reports will be found under V, Public Education, of this report.

II. Control Activities in Honolulu

The importance of Aedes mosquito control activities in Honolulu were re-emphasized with the occurrence of two proven cases of dengue noted as acquired in the Territory of Hawaii. Following the report of these two cases special precautions were taken which included spraying the inside of premises and places where the patients visited during the infectious period of the disease. The exterior of premises surrounding the cases were also sprayed for adult kill. In each case special investigations were made for larval breeding and intensified larval inspections were made by the inspection crews in each particular zone. This policy has been carried out with each dengue suspect as soon as reported, whether proven or not.

During the month of May final checks on the use of DDT as a larvicide for Aedes mosquito control were made and one crew was equipped with applicators using a suspension of DDT. Details of this method will be found under VI, Entomological Work, of this report.

#### A. Inspection Activities

The citywide Aedes breeding index in Honolulu was 1.8% on May 15 and 1.3% on May 31. At the end of May, 12 zones had indexes above 3% and 6 zones had indexes above 5%. The Aedes breeding indexes for the 19 critical zones varied as follows:

.0%	-	.5%	--	8
.6	-	1.0	--	3
1.1	-	1.5	--	5
1.6	-	2.3	--	3

Following is a summary of the inspection activities:

No. of premises inspected	48,942
No. of premises breeding <u>Aedes</u>	789
<u>Aedes</u> breeding index on May 31	1.3%
No. of inspections per man-day	44.5

#### B. Special Work

##### 1. Larviciding Activities

The following mosquito breeding places were sprayed with diesel oil:

catch basins--24  
ground pools--20  
ditches--9  
pillboxes--6  
bomb shelters--4  
cesspools--3

The motorcycle Servi-car was used to larvicide 282 catch basins.

##### 2. Tree and Rock Hole Filling

A total of 752 tree holes were filled, of which 21 or 2.7% were found breeding. Two hundred forty-nine rock holes were filled, of which 12 or 4.8% were breeding. In addition, 25 bamboo stumps and 183 pipe holes were filled.

##### 3. Clean-up Crew

A total of 16 loads of containers were collected and hauled away, of which 7 were from the Central district, 1 from the Kapahulu district and 8 from the Lanakila district.



The 760th Medical Sanitary Company clean-up crew which returned to work on May 17 cleaned out the badly overgrown Pauoa Stream between Vineyard and Lusitana Streets. Twelve loads of containers were removed from this stream.

#### 4. Fish Stocking

Twenty barrels and one fish pond were stocked with mosquito minnows during May.

#### 5. Inspection of USED Base Yards and Waterfront Area

Complete inspections of 37 USED base yards were made. AEDES breeding was found 16 times.

Forty complete inspections were made in the waterfront area. Aedes breeding was found 2 times.

#### C. Personnel

	<u>Field</u>	<u>Total</u>
Army	67	67
Chamber of Commerce	2	4
U. S. Public Health Service	<u>19</u>	<u>29</u>
Total	88	100

### III. Rural Oahu Program

Personnel--60

The 760th Medical Sanitary Company resumed inspection activities in rural Oahu on May 17. Three inspectional teams were formed and operations expanded to cover towns on windward Oahu, namely, Kaneohe, Kailua, Lanikai and Waimanalo. The following is a summary of inspection activities in rural Oahu:

	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Man-Days</u> <u>in</u> <u>Field</u>
Aiea	386	6	1.5	13
Ewa	865	14	1.6	25
Haleiwa	200	2	1.0	7.5
Kailua	374	11	2.9	16
Kaneohe	246	9	3.6	9
Lanikai	205	10	4.8	7
Pearl City	492	8	1.6	12.5
Waialua	504	4	.7	13
Wahiawa	950	17	1.8	19
Waimanalo	174	4	2.2	6.5
Waipahu	<u>812</u>	<u>16</u>	<u>1.9</u>	<u>21</u>
Total	5208	101		149.5

#### IV. Hilo, Hawaii Program

##### Personnel--1

Inspectional activities were carried on by the foreman during the month of May. Four inspectors were recruited and will report for duty on June 1 for training and regular inspectional work under Mr. Munro. Following is a summary of inspectional activities for the month of May:

No. of premises inspected        519  
No. of premises breeding Aedes   30  
Aedes breeding index on May 31   5.8%

#### V. Public Education

##### A. School Program

The following table is a summary of the reports from the Island of Hawaii for the month of May and the Island of Maui for the month of April:

	<u>Hawaii</u> <u>May</u>	<u>Maui</u> <u>April</u>
No. of schools reporting	49	21
No. of students in the 4th grade and up	12,658	8,204
No. of students reporting	9,004	6,223
Per cent of students reporting	71%	75%
No. of containers found	17,764	9,758
No. of containers with wrigglers	5,679	2,578
Container breeding index	32.0%	26.4%
(Container breeding index for previous month)	32.7%	22.3%

##### B. News Releases

During the month 10-1/2 column inches of English and 5 column inches of foreign language news articles appeared in local papers.

#### VI. Entomological Work

##### A. DDT for Aedes Mosquito Control

It is hoped that DDT will prove to be the ideal larvicide for Aedes mosquito control. Laboratory and field tests using DDT have been run on the mosquito control program. The following is a report of preliminary tests to determine satisfactory methods of application.



In order to minimize damage to water-holding plants, it was decided to avoid hydrocarbon solvents and to utilize the DDT in emulsion form. Initially, an emulsion of DDT containing approximately 1% of Vatsol was used to stabilize the emulsion. It was found, however, that solutions of Vatsol alone would kill plants. Consequently, this form of solution was limited. A subsequent test utilizing DDT in alcohol indicated that no damage occurred in the plants which are constant sources of Aedes mosquito breeding. These tests are summarized below:

A vine bowl containing approximately one-half pint of water was treated with 1 cc. of 1-1/2% DDT in alcohol. The water in the vine bowl was tested at regular intervals by observation of the mortality after 24 hours of introduced larvae. After 4 months the kill remained at 100%. The vine growing in the bowl has shown no adverse effects. A control of vine bowl showed no mortality.

Pineapple lilies, spider lilies and ape plants were treated at the base of each leaf and no adverse effects were found on the plants after one month. Tests of breeding in the pineapple lilies were carried out similar to the above test and 100% mortality was obtained after 4 months.

A 55 gallon barrel was treated with 1 cc. of 1-1/2% DDT in alcohol and although first instar larvae were observed after 20 days, fourth instar larvae were not observed until 44 days after treatment. A control barrel contained all stages of larvae on all dates of observation.

A series of tin cans were similarly treated and 100% control was obtained through 4 months of observation. The only adverse effect was the presence of extensive corrosion in the tin cans treated with DDT. The observations of residual effect are being continued.

The method of application that was decided upon was the use of an Eagle #66 Super Oiler which enables the operator to apply a control dosage of approximately 1 cc. The solution that is applied consists of a suspension of 6 grams of DDT dissolved in 400 cc. of 95% Ethyl alcohol mixed with approximately 1600 cc. of water. This gives a final concentration of .003 grams per cc. After mixing, this suspension is milky in color and finely dispersed. However, on standing the suspension produces large, soft flucculent particles which partially settle out. This flucculent precipitate does not interfere in the use of the applicator and tests to determine kill and residual effect have shown this suspension to be satisfactory. A preliminary trial of the use of these applicators by the inspectors was made in the Buckle Lane area of zone 8-B. The applicator and the methods set up have appeared satisfactory on the basis of this preliminary trial. No difficulty was experienced due to failure of the guns to operate. No containers were encountered which could not be treated. Treated containers have been observed and no breeding has been found after being deliberately left containing water after treatment. All evidence at hand points to the present method as a highly practical means of utilizing DDT in the control of Aedes mosquitoes. The only limitation to date is the high toxicity of DDT to fish; hence fish ponds and fish bowls are not treated.

All other water containers, wet or dry, natural or artificial, are being treated with approximately 1 cc. of the suspension per pint of water.

#### B. Rainfall Data

Included with this report is a graph showing the average rainfall in inches for each week from February 16, 1944 to April 17, 1945. On the same sheet is graphed for the same period the citywide Aedes breeding index for the periods ending the first and fifteenth of each month and the total man-days worked semi-monthly. This is a continuation of the previous graphs presented in the narrative reports of December 31, 1943 and April 30, 1944 with the total man-days worked semi-monthly graph added.

### VII. Miscellaneous

#### A. Manpower

Reference is made to the total man-days worked semi-monthly curve on the rainfall-Aedes breeding index graph included with this report. It is significant to note that there has been an approximate 40 per cent reduction since August 1944. Special efforts are being made to increase civilian personnel, the number of which have also declined, along with the number of military personnel assigned to this program. However, the supply of adequate civilian personnel is still limited, according to the Civil Service Commission, and no great increase in personnel from this source is anticipated.

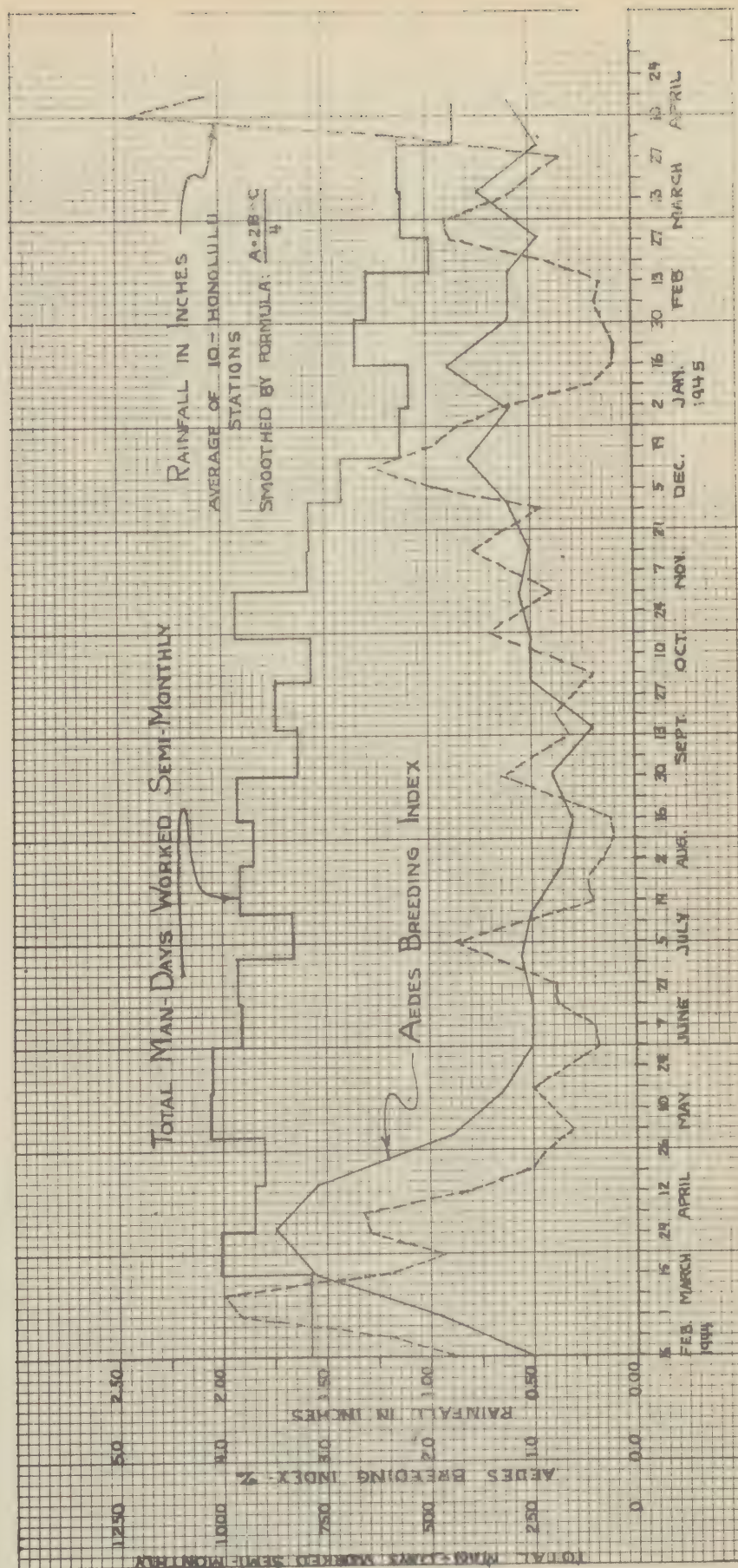
Respectfully submitted,

/s/ Arve H. Dahl

Arve H. Dahl  
P. A. Sanitary Engineer (R)  
i/c Dengue Mosquito Control

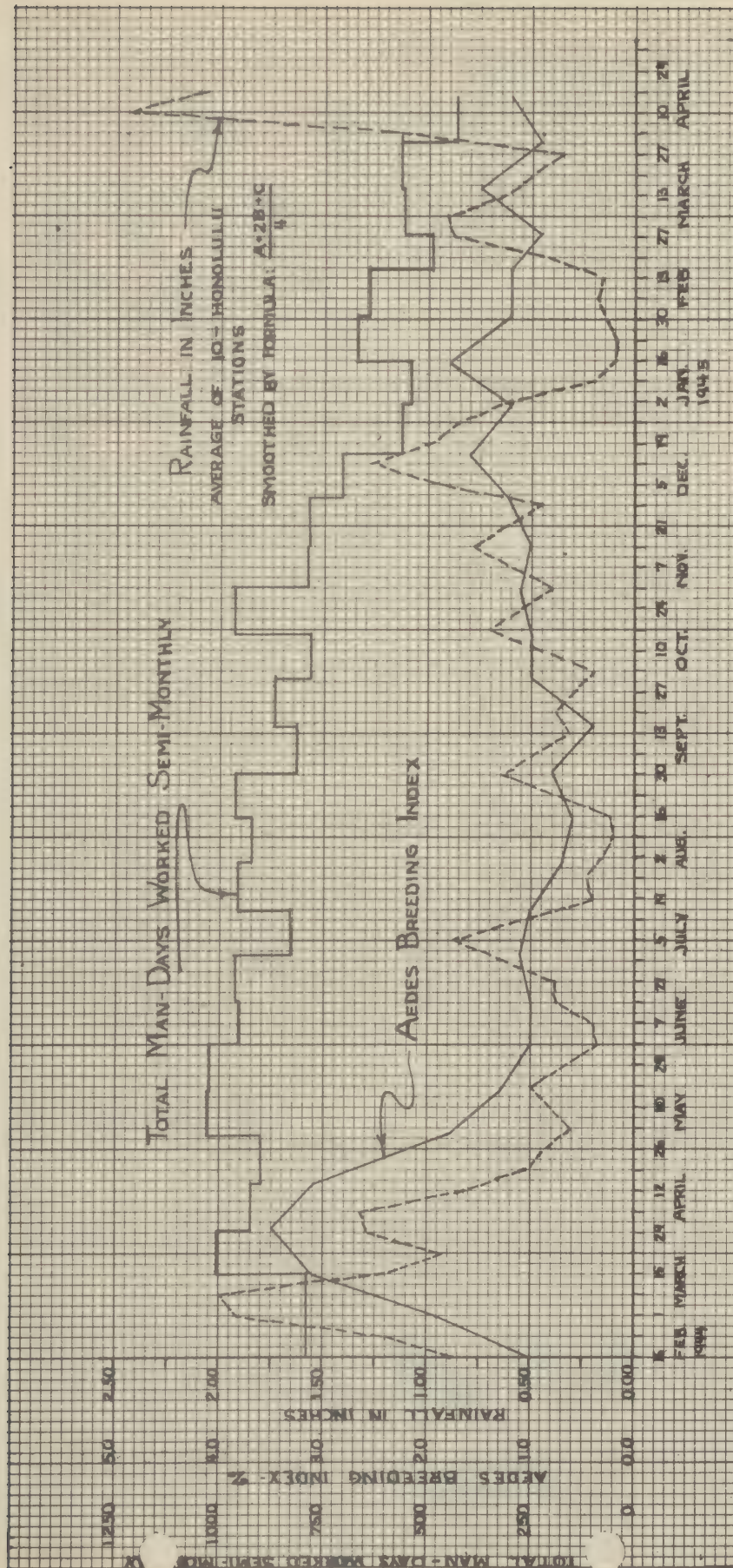


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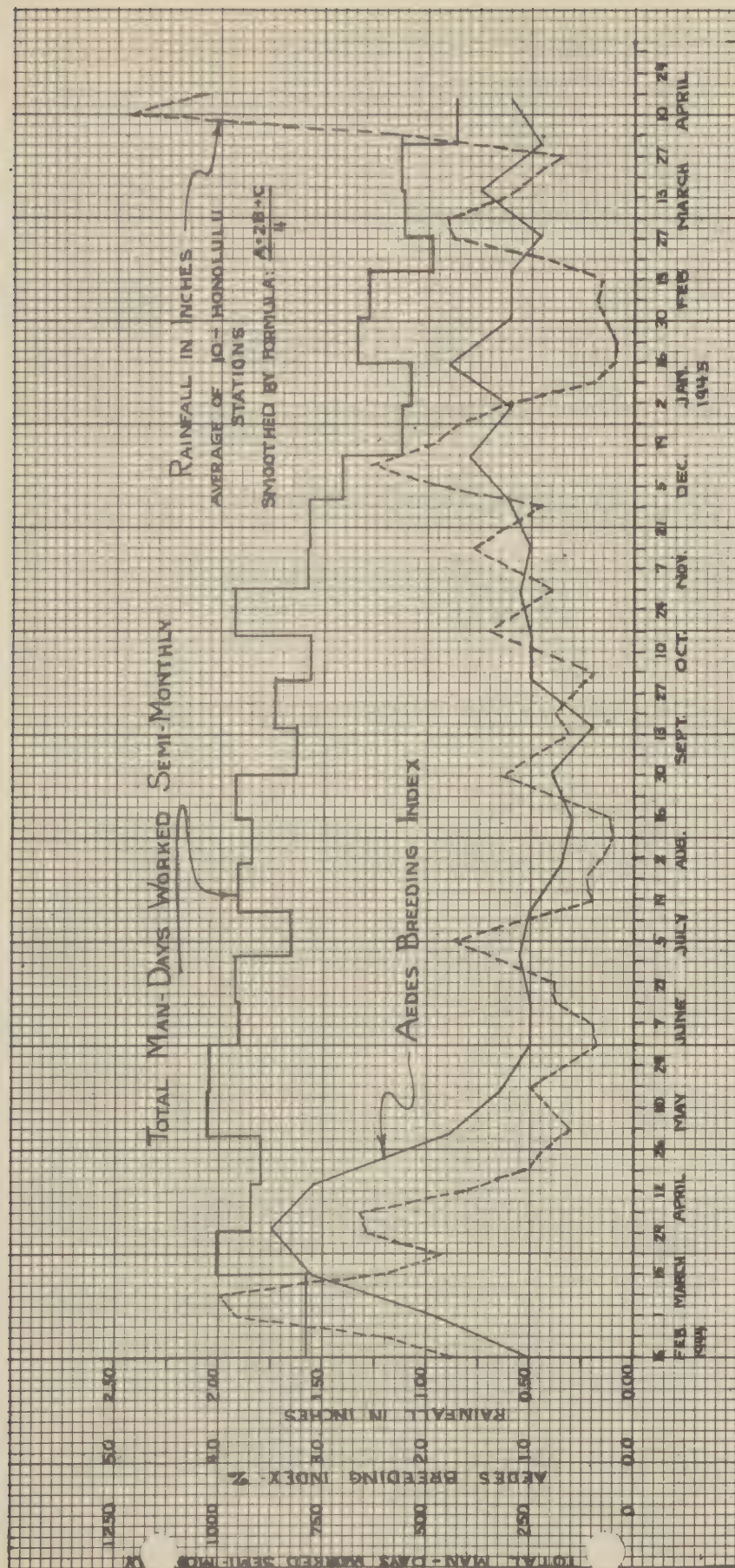
















FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
April 1945

I. Monthly Summary

A. Dengue Fever Cases--Non-military

Cases acquired within Territory--0  
Cases "off-shipping"--0

B. Control Program--Territorywide (As covered in this report)

No. of premises inspected	38,724
No. of premises breeding <u>Aedes</u>	604
Total personnel engaged in program	102

C. School Program

Reports from the County Health Officer on the Island of Hawaii on the school mosquito control program are summarized as follows:

No. of students reporting	8,893
No. of wet containers found	19,250
No. of containers with wrigglers	6,303

A more detailed report on the school program will be found under V, Public Education, of this report. The report on the Maui School Report was not received in time to be included.

II. Control Activities in Honolulu

A. Inspection Activities

The citywide Aedes breeding index in Honolulu was 1.2% on April 15 and 1.7% on April 30. At the end of April, 6 zones had indexes above 3% and 2 zones had indexes above 5%. The zones having indexes above 5% are located in Nuuanu Valley and the Upper Fort Street area.

The Aedes breeding index for the 19 critical zones at the end of April varied as follows:

0.0% - 0.5%	--	8 zones
0.6% - 1.0%	--	4 "
1.1% - 1.5%	--	5 "
1.6% - 2.5%	--	2 "

Following is a summary of the inspection activities:

No. of premises inspected	38,404
No. of premises breeding <u>Aedes</u>	587
<u>Aedes</u> breeding index on April 30	1.7%
No. of inspections per man-day	46.2

## B. Special Work

### 1. Larviciding Activities

The power sprayer was used to larvicide the swamp next to Lanakila School and King and Liliha Streets. In addition, the following mosquito breeding places were sprayed with diesel oil:

- storm drains--22
- ground pools--18
- bomb shelters--14
- ditches--8
- pillboxes--6
- fish ponds--3
- swamps--2
- cesspools--2

The motorcycle Servi-car was used to larvicide 915 catch basins.

### 2. Insecticide Spraying

The power sprayer was utilized in spraying seven premises in the Kapahulu district.

### 3. Tree and Rock Hole Filling

A total of 674 tree holes were filled, of which 37 or 5.4% were found breeding. One hundred eighty-six rock holes were filled, of which 6 or 3.2% were breeding. In addition, 35 bamboo stumps and 16 pipe holes were filled.

### 4. Clean-up Crew

A total of 16 loads of containers were collected and hauled away, of which 4 were from the Central district, 4 from the Kapahulu district and 8 from the Lanakila district.

### 5. Fish Stocking

Seven barrels, 5 fish ponds, 1 swamp and 1 ditch were stocked with mosquito minnows during April.



## 6. Inspection of USED Base Yards and Waterfront Area

Complete inspections of 23 USED base yards were made. Aedes breeding was found 10 times.

Thirty-two complete inspections were made in the waterfront area. No Aedes breeding was found.

### C. Personnel

	<u>Field</u>	<u>Total</u>
Army	69	69
Chamber of Commerce	2	4
U. S. Public Health Service	<u>19</u>	<u>28</u>
TOTAL	90	101

## III. Wahiawa and Rural Oahu Programs

These two programs were consolidated towards the end of March to be operated under the 760th Medical Sanitary Company. On April 1 an urgent military need arose which necessitated the transferring of this company to other work. It is anticipated that they will be returned to this program to continue the Wahiawa and rural Oahu programs on or about May 15.

## IV. Hilo, Hawaii Program

### Personnel--1

Mr. Arthur Munro, foreman of the Hilo mosquito control project, carried on regular inspection activities as a part of his training. From April 9 through April 14 Mr. Munro was given special training in Honolulu in preparation for hiring the inspection crew for the Hilo program. It is anticipated that Mr. Munro will train these inspectors under the supervision and direction of P. A. Sanitary Engineer (R) Bernard B. Berger, County Sanitary Engineer. Following is a summary of inspection activities for the month of April:

No. of premises inspected	320
No. of premises breeding <u>Aedes</u>	17
<u>Aedes</u> breeding index	5.3%

## V. Public Education

### A. School Program

Only reports from the schools on the Island of Hawaii are available on the school Mosquito Control Day conducted in cooperation with the Department of Public Instruction on the

Islands of Hawaii and Maui during the month of April. The following table is a summary of the reports from all schools reporting:

No. of schools reporting	44
No. of students in 4th grade and up	12,110
No. of students reporting	8,893
Per cent of students reporting	73%
No. of containers found	19,250
No. of containers with wrigglers	6,303
Container breeding index	32.7%

(The container breeding index for March--35.9%)

#### B. News Releases

During the month 32 column inches of English and 16 column inches of foreign language news articles appeared in local papers.

### VI. Miscellaneous

#### A. Entomological

Experiments were continued on the use of DDT for Aedes mosquito control.

Respectfully submitted,

/s/ Arve H. Dahl

Arve H. Dahl  
P.A. Sanitary Engineer (R)  
i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
March 1945

I. Monthly Summary

A. Dengue Fever Cases--Non-Military

Cases acquired within Territory--2  
Cases "off shipping"--0

B. Control Program--Territorywide (as covered in this report)

No. of premises inspected	65,647
No. of premises breeding <u>Aedes</u>	850
Total personnel engaged in program	158

During the month of March control activities were expanded to include six towns in rural Oahu and Hilo, Hawaii.

C. School Program

Reports from the County Health Officers on the Islands of Hawaii and Maui, on the school mosquito control program, are summarized as follows:

Number of students reporting	14,949
Number of wet containers found	31,185
Number of containers with wrigglers	9,813

A more detailed report on the school program will be found under VI, Public Education of this report.

II. Control Activities in Honolulu

A. Inspection Activities

The citywide Aedes breeding index in Honolulu was 1.6% on March 15 and 0.9% on March 31. At the end of March, 8 zones had indexes above 3% and 5 zones had indexes above 5%. The location of zones having indexes above 5% are as follows: one in upper Kalihi Valley; three in Nuuanu Valley above Judd Street; and one in Mānoa Valley behind the University.

The Aedes breeding index for the nineteen critical zones at the end of March varied as follows:

0.0% - 0.5%	--	15 zones
0.6% - 1.0%	--	3 "
1.6%		1 "

Following is a summary of the inspection activities:

No. of premises inspected	57,278
No. of premises breeding <u>Aedes</u>	732
<u>Aedes</u> breeding index on March 31	0.9%
No. of inspections per man-day	52.6%

## B. Special Work

### 1. Tree and Rock Hole Filling

A total of 507 tree holes were filled, of which 10 or 2% were found breeding. One hundred forty-one rock holes were filled, of which 6 or 4% were breeding.

### 2. Larviciding Activities

The power sprayer was used to larvicide swamps on Kalauekalani Way and Kalakaua Avenue, back of the Church of the Crossroads, back of 625-B Waiakamilo Road and a stream on Aukei and Oili Roads. In addition, the following mosquito breeding places were sprayed with diesel oil:

ground pools--	23
catch basins--	16
ditches--	9
cesspools--	8
bomb shelters--	4
fish ponds--	4

The motorcycle Servi-car was used to larvicide 738 catch basins.

### 3. Insecticide Spraying

The power sprayer was utilized in spraying the area around Royal Hawaiian Hotel. An area bounded by Kapalama Canal, School Street, Palama Street and King Street which consistently contained a high number of secondary breeders was also sprayed. Approximately, 1,135 gallons of insecticide were used.



#### 4. Clean-up Crew

A total of 6 loads of containers was collected and hauled away, of which 1 was from the Central District, 2 from the Kapahulu District and 3 from the Lanakila District.

The clean-up crew of the 760th Medical Sanitary Company detailed for mosquito control cleaned out 900 feet of a tributary to Kapalama Canal, hauling 12 loads of containers to the dump. On Pauoa Stream 400 feet of ditching in the stream bed were cleaned and 4 loads of containers were hauled away.

#### 5. Fish Stocking

Twenty-one barrels and 5 fish ponds were stocked with mosquito minnows during February.

#### 6. Inspection of USED Base Yards and Waterfront Area

Complete inspections of 29 USED base yards were made. Aedes breeding was found six times.

Seventy-six complete inspections were made of the waterfront area. No Aedes breeding was found.

#### C. Personnel

	<u>Field</u>	<u>Total</u>
Army	77	77
Chamber of Commerce	2	4
U. S. Public Health Service	19	30
Total	98	111

### III. Wahiawa Program

#### Personnel--4

The citywide Aedes breeding index in Wahiawa was 0.6% in mid-March, and 0.4% at the end of the month. Following is a summary of the inspection activities for March:

No. of premises inspected	1,642
No. of premises breeding <u>Aedes</u>	9
<u>Aedes</u> breeding index on March 31	0.4%
No. of inspections per man-day	43.1

#### IV. Rural Oahu Program

##### Personnel--42

The training of the 760th Medical Sanitary Company in dengue mosquito control was completed on March 3. Control operations in rural Oahu were started on March 5 with control crews in Waipahu and Aiea. Forty-two men have been assigned to work on the dengue mosquito control program to form three inspection crews of eight men each, leaving eighteen men for special activities to include larviciding, clean-up and other activities as needed. The clean-up crew was assigned temporarily to take care of a back log of specific clean-up jobs in Honolulu.

The following is a summary of the inspection activities carried on in the towns listed in rural Oahu:

	<u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>No. Insp.</u> <u>Per Man-Day</u>
Aiea	1254	18	0.9	26
Ewa	1601	5	0.2	47
Pearl City	816	15	0.4	17
Waipahu	1897	11	0.4	32
Waialua	158	--	--	45
Haleiwa	226	8	3.5	20
Totals				

#### V. Hilo, Hawaii Program

##### Personnel--1

The foreman hired for the Hilo program has been carrying on regular inspection activities as a part of his training. The following is a summary of the results of his inspection activities carried on under the direction of P. A. Sanitary Engineer (R) Bernard B. Berger, County Sanitary Engineer:

	<u>February 15-28</u>	<u>March</u>
No. of premises inspected	127	479
No. of premises breeding <u>Aedes</u>	14	38
<u>Aedes</u> breeding index	11.0%	7.9%

#### VI. Public Education

##### A. School Program

The school Mosquito Control Day being conducted in cooperation with the Department of Public Instruction on the Islands of



Hawaii and Maui were carried out as planned on the first Friday of March. The following table is a summary of the reports from all schools reporting:

	<u>Hawaii</u> <u>March</u>	<u>Feb.</u>	<u>Maui</u> <u>March</u>
No. of schools reporting	45	12	21
No. of students in 4th grade and up	12,565	3,415	8,061
No. of students reporting	8,954	2,376	6,095
% of students reporting	71%	69%	75%
No. of containers found	20,956	4,179	10,229
No. of containers with wrigglers	7,528	995	2,285
Container breeding index	35.9	23.7	22.3

As the first summary report for Maui was not in at the time the February narrative report was written, the results are included in the foregoing table.

#### B. Film

Two copies of the film "Miss Skeeter Goes to Town" were received from the "Malaria Control in War Areas" office in Atlanta, Georgia. Local comments by health officials are to the effect that this picture is one of the best health films yet made. Arrangements have been made to send this film to public schools through the Director of Health Education of the Board of Health. The program was inaugurated by showing the film at a preview of health department films given for the Department of Public Instruction and other community organizations interested. To date the film has been shown to four schools having an approximate enrollment of 1,260 students. Other showings have been at the Kapahulu Health Center in Honolulu and the Rat and Mosquito Control Committee of the Honolulu Chamber of Commerce.

#### C. News Releases

During the month 40 column inches of English and 20 column inches of foreign language news articles appeared in local papers.

#### D. Radio

A local radio station broadcast in its daily news program included the occurrence of the two dengue cases in Honolulu as soon as they were reported by the Board of Health.

# VIII. Miscellaneous

## A. Entomological Work

Experiments were continued to determine the factors which must be known before DDT can be used as a larvicide on routine inspection activities.

## B. Kahuku, Oahu Survey

A request was received for information regarding the Aedes mosquito population near the Kahuku Air Strip. In a special survey made on March 22, 169 premises were inspected and no Aedes breeding was found. It was learned that this area had not had a prolonged rain since December 1944. As a result, containers which ordinarily could be expected to contain water were dry.

Respectfully submitted,

/s/ Arve H. Dahl

Arve H. Dahl  
P. A. Sanitary Engineer (R)  
i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
February 1945

I. Monthly Summary

A. Dengue Fever Cases--Non-Military

Cases acquired within Territory--0  
Cases "off shipping"--0

B. Control Program--Territorywide (As covered in this report)

No. of premises inspected	54,804
No. of premises breeding <u>Aedes</u>	578
Total personnel engaged in program	122

Regular control activities during the month of February were limited to the Island of Oahu. Inspection activities were carried on only in Honolulu and Wahiawa.

The figures quoted above for the control program do not include the results of the school Mosquito Control Day. Results of the fourth complete report on the Island of Hawaii will be found under IV, Public Education, of this report.

II. Control Activities in Honolulu

A. Inspection Activities

The citywide Aedes breeding index in Honolulu was 1.2% on February 15 and 0.9% on February 28. At the end of February, 3 zones had indexes above 3% and there were no zones with indexes above 5%.

The 19 critical zones in Honolulu are being worked on a 10-12 day cycle while the average inspection cycle for the remaining 58 zones is somewhat less than 24 days. Inspection results for the month of February show that the breeding index for the 19 critical zones was 0.5% while that for 53 of the non-critical

zones was 1.2%. Following is a summary of the month's activities:

No. of premises inspected	52,476
No. of premises breeding Aedes	566
Aedes breeding index on February 28	0.9%
No. of inspections per man-day	49.3

## B. Special Work

### 1. Tree and Rock Hill Filling

A total of 1,503 tree holes were filled, of which 21 or 1.4% were found breeding. Five hundred sixty-eight rock holes were filled, of which 4 or 0.7% were breeding. In addition, 331 upright pipes were filled.

### 2. Larviciding Activities

The power sprayer was used to larvicide swamps on Damon Estate in Moanalua Gardens and Damon Tract near D. Road; the stream next to Waialae Golf Course; and the area near 462 Hobron Lane, back of Lanakila School, Kam Highway, Middle Street and Sheridan Street. In addition, the following mosquito breeding places were sprayed with diesel oil:

ground pools--14  
storm drains--12  
cesspools--11  
ditches--3

### 3. Storm Drain and Catch Basin Larviciding

The motorcycle (Servi-car) which has been laid up for repairs for the past few months was placed in operation during February to larvicide catch basins, storm drains, etc. The spraying is accomplished by means of a regular spray can shut-off nozzle supplied by a rubber hose from the 25-gallon pressure oil tank mounted above the rear axle of the machine. Approximately 15 gallons of oil are added to the tank and pressure is obtained by using compressed air at service stations.

The main section covered is between the waterfront and Beretania Street from Fort Street to Ward Street in which there are approximately 600 storm drains and/or catch basins to larvicide, a great many of which continually hold water. Other sections of the city which have similar problems will be covered in a minimum of time with this machine. During February 570 storm drains were larvicided.



#### 4. Roof Gutters

The roof gutters on 13 premises were corrected during the month.

#### 5. Clean-up Crew

A total of 32 loads of containers were collected and hauled away, of which 7 were from the Central District, 3 from the Kapahulu District and 22 from the Lanakila District.

#### 6. Fish Stocking

Five fish ponds, two swamps and ten barrels were stocked with mosquito minnows during February.

#### 7. Inspection of USED Base Yards and Waterfront Area

Complete inspections of 29 USED base yards were made. Aedes mosquitoes were found 3 times.

Fifty-three complete inspections were made of the waterfront area. No Aedes breeding was found.

#### C. Personnel

	<u>Field</u>	<u>Total</u>
Army	78	78
Chamber of Commerce	3	6
U. S. Public Health Service	<u>23</u>	<u>34</u>
TOTAL	104	118

### III. Wahiawa Program

#### Personnel--4

The citywide Aedes breeding index in Wahiawa was 0.5% in mid-February. No Aedes breeding was found for the latter part of February. This is the first semi-monthly period in which no Aedes breeding was found since the start of the control program and reflects the fine spirit of cooperation from the householders in that community. Following is a summary of the inspection activities for February:

No. of premises inspected	1,131
No. of premises breeding <u>Aedes</u>	5
<u>Aedes</u> breeding index on February 28	---
No. of inspections per man-day	32.5

#### IV. Public Education

##### A. Hawaii School Program

During the month of February the school Mosquito Control Day was extended to 11 schools in the Kona district on the Island of Hawaii. P. A. Sanitary Engineer (R) Arve H. Dahl spoke to each school, explaining the problem of Aedes mosquito control and the participation of the students in the program. These schools participated in the February Mosquito Control Day. Out of the 12,720 students above the fourth grade, 9,247 turned in a report on the fourth Mosquito Control Day on the Island of Hawaii. Of 22,240 containers found containing water, 8,054 contained wrigglers, giving a container breeding index of 36.2%, as compared with 28.6% for January. In analyzing the results, it is observed that this increase was due to two things: (1) the high container breeding index in the Kona schools, which was 45.5%, and (2) a slight increase in many schools, due, undoubtedly, to increased rainfall on the island.

##### B. Maui School Program

The school mosquito control program was extended to 22 schools on the Island of Maui during February. Assistant Sanitarian (R) Wendell R. McCool and P. A. Sanitary Engineer (R) Arve H. Dahl visited the island to inaugurate the program. Talks were given to each school, explaining methods of Aedes control and the plan for the participation of all students above the fourth grade in the program.

##### C. News Releases

During the month 52 column inches of English and 30 column inches of foreign language news articles appeared in local papers.

#### V. Miscellaneous

##### A. Entomological Work

The efforts of the entomological staff are being directed towards determining the most efficient methods of using DDT on regular inspectional programs for the control of Aedes mosquitoes. Applications in powder as well as liquid form is being considered.



B. Control Program in Hilo, Hawaii

A foreman has been hired for the purpose of establishing an Aedes mosquito control program in Hilo, Hawaii. He is receiving preliminary training from P.A. Sanitary Engineer (R) Bernard B. Berger, County Sanitary Engineer.

Respectfully submitted,

/s/ Arve H. Dahl  
Arve H. Dahl  
P. A. Sanitary Engineer (R)  
i/c Dengue Mosquito Control





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
January 1945

I. Monthly Summary

A. Dengue Fever Cases--Non-military

Cases acquired within Territory--0  
Cases "off shipping"--0

B. Control Program--Territorywide (As covered in this report)

No. of premises inspected	55,823
No. of premises breeding <u>Aedes</u>	757
Total personnel engaged in program	163

Regular control activities during the month of January were limited to the Island of Oahu. Inspection activities in rural Oahu were suspended on January 20 when the 719th Medical Sanitary Company was reassigned for training for duties in forward areas.

On the Island of Hawaii, the third complete monthly school Mosquito Control Day was held on the first Friday of January. Results of this control activity will be found under V, Public Education of this report.

II. Control Activities in Honolulu

A. Inspection Activities

The citywide Aedes breeding index in Honolulu was 1.8% on January 15 and 1.2% on January 31. At the end of January, 6 zones had indexes above 3% and 2 zones had indexes above 5%. Following is a summary of the month's activities:

No. of premises inspected	50,536
No. of premises breeding <u>Aedes</u>	724
<u>Aedes</u> breeding index on January 31	1.2%
No. of inspections per man-day	47.3

## B. Special Work

### 1. Insecticide Spraying

The power sprayer was utilized in spraying USED base yard No. 7, a junk yard near the Kapalama Canal and an area on Liholiho Street.

### 2. Tree and Rock Hole Filling.

One thousand nine hundred sixty-nine tree holes were filled, of which 32 or 1.6% were breeding. One hundred thirty-nine rock holes were filled, of which 7 or 5% were breeding and 425 upright pipes and 63 bamboo stumps were filled.

### 3. Larviciding Activities

The power sprayer was used to larvicide the following swamp areas: Kalakaua and Kalanokalani Avenues, between Makaoe and Makaoe Lanes, Kapiolani Boulevard next to Kalakaua Homes, along Kalanokalani and Kapiolani Boulevard and along Date Street; the following ditches were also larviced: on Rycroft Street, on Kona and Piikoi Streets, on the 1300 block on Houghtailing Road, at Kapiolani Boulevard and Ward Avenue, on Oili Road, at Waiialae Golf Course and on Sheridan Street. A total of 385 gallons of diesel oil was used to larvicide these areas.

### 4. Roof Gutters

The roof gutters on 5 premises were corrected during the month.

### 5. Clean-up Crew

A total of 33 loads of containers were collected and hauled away, of which 28 were from the Lanakila district, 4 from the Central district and 1 from the Kapahulu district.

### 6. Fish Stocking

Four fish ponds and two catch basins were stocked with mosquito minnows during January.

### 7. Inspection of USED Base Yards and Waterfront Area

Complete inspections of 27 USED base yards were made. Aedes mosquitoes were found breeding 14 times.

Sixty-one complete inspections were made of the waterfront area. Aedes breeding was found once.



### C. Personnel

	<u>Field</u>	<u>Total</u>
Army	79	79
Chamber of Commerce	3	6
U. S. Public Health Service	23	34
TOTAL	105	119

### D. Report of Honolulu Supervisor

In the preceding two months, personnel shortages caused a serious extension in the number of days required for each inspection cycle in all areas. At a conference with the Officer in Charge, it was deemed advisable to concentrate inspections on certain critical areas where an outbreak of dengue fever would be considered most likely to occur. These areas were selected on the basis of (a) population concentration, (b) occurrence of dengue cases during the 1943-44 epidemic, and (c) areas most visited by military personnel who might be a source of infection. Nineteen critical zones were selected, which will be inspected on the regular 10-12 day cycle. The remainder of the zones will be inspected on extended cycles, the number of calendar days varying with the available manpower.

The clean-up crew devoted most of its time to systematic house-to-house clean-up in two large critical zones in the Lanakila district where persistent breeding in artificial containers has occurred. In the future, the clean-up crew will be utilized more for routine work of this nature, the value of which has been adequately shown by the lowering of indexes in the zones mentioned.

### III. Wahiawa Program

#### Personnel--4

The citywide Aedes breeding index in Wahiawa was .5% in mid-January and .6% at the end of the month. Following is a summary of the inspection activities for January:

No. of premises inspected	2,231
No. of premises breeding <u>Aedes</u>	13
<u>Aedes</u> breeding index on January 31	.6%
No. of inspections per man-day	43.4

During the month of January Aedes mosquitoes were found breeding only in artificial containers--barrels, tubs, tin cans and ant cups.

#### IV. Rural Oahu Program

Personnel--40

The rural Oahu program, which has been carried on by the 719th Medical Sanitary Company, was terminated on January 20 when the Company was reassigned for training for duty in forward areas. During the first part of January part of the personnel was taking part in other required training. As a result, the maximum number of workers during the month of January totaled 40.

A total of 3,056 premise inspections were made during the first half of January, of which 20 were found breeding Aedes, giving an index of .6%. Following is a list of the Aedes breeding indexes as of January 15:

<u>Town</u>	<u>Aedes Breed.</u>		<u>Town</u>	<u>Aedes Breed.</u>	
	<u>Index</u>			<u>Index</u>	
Aiea	1.3		Pearl City	.2	
Ewa	.5		Waialua	.5	
Haleiwa	2.7		Waipahu	.5	

The 719th clean-up crew activities were confined to Pearl City, making a complete clean-up of all vacant lots. Several breeding junk piles were removed. In all, 20 loads of cans, bottles, etc. were hauled to the Pearl City dump. This crew also larvicided 2 large swampy areas in Pearl City using Quartermaster DDT-kerosene larvicide in a power sprayer with excellent results on Culex breeding.

#### V. Public Education

##### A. Hawaii School Program

Excellent results of the third school Mosquito Control Day held on the first Friday of January show an encouraging continued interest. The report for January reveals that 71% or 7,468 of the students above the fourth grade reported. A total of 13,355 containers were found, of which 3,816 were breeding, giving a container breeding index of 28.6% as compared with 30.3% in December.

##### B. News Releases

During the month of January, 36 column inches of English and 24 column inches of foreign language news articles appeared in local papers.

##### C. Magazine Article

The January issue of the Hawaii Farm and Home magazine, which has a Territorywide circulation of over 12,000, carried a two-page article



of the dengue mosquito control program.

Mr. Donald Burum, Editor of the magazine, attended the complete course given regularly to new employees and soldiers assigned to the program. This article is the result of his attending this course. Besides emphasizing the purpose and value of the program, street markings, house markings and the uses of various pieces of equipment in the inspector's kits are all illustrated fully with diagrams and photographs.

#### D. Talks

A lecture on dengue mosquito control was given to the junior and senior classes of Queen's Hospital Nursing School by Assistant Sanitarian (R) David D. Bonnet on January 30. Charts of the Aedes breeding cycle, live larvae and adult mosquito samples, as well as various types of plants and containers which are common mosquito breeding places in Hawaii, were used by Dr. Bonnet to illustrate his lecture. In conclusion, the Aedes aegypti control film was shown.

#### VI. Entomological Work

The following material is abstracted from the reports of Assistant Sanitarian (R) David D. Bonnet:

##### A. Effect of DDT on Plants

It is well known that many types of larvicides used in mosquito control are detrimental to plants. A few preliminary experiments have been performed and more are underway at the present time, to determine the effect of different DDT concentrations on various plants. Three species of plants in Hawaii which collect water in the axils of the leaves and which have been serious sources of mosquito breeding are being tested.

<u>Common Name</u>	<u>Scientific Name</u>
Ape or Elephant Ear	<u>Alocasia</u> sp., probably a variety of <u>Alocasia macrorrhiza</u> Schtt.
Spider Lily	<u>Crinum asiaticum</u> Linneaus <u>Crinum giganteum</u> Andrews
Pineapple Lily	<u>Billbergia thyrsoides</u> Van Martins

The first species, Alocasia, or ape, has been tested with large concentrations of DDT applied directly to the Axils of the plant in alcoholic solution and in emulsion form with Vatsol. In addition, controls were set up using straight alcohol and straight aqueous solution of Vatsol. In no case has there been observed any ill effects on the plant up to the present time (30 elapsed days). Trials are now being made on the other species.

## B. Laboratory

During this month the identification of samples has been continued but on a modified scale. Complete identifications are being made on all samples from the 19 critical zones. The samples from the other zones are examined to insure correct field identification but the examinations to separate Aedes aegypti from Aedes albopictus are not made. The total number of samples handled by the laboratory during January was 950.

Mr. Douglas Worcester, assistant at the laboratory, resigned to accept a position with the Territorial Board of Agriculture and Forestry as Plant Quarantine Inspector of Maui.

## VII. Analysis By Type of Containers Inspected and Containers Found Breeding Aedes in Honolulu

The following figures for the last quarter of 1944 and the entire year of 1944 are analyses of various types of actual and potential Aedes breeding places, ranked according to importance and showing the percentage which each type of container assumes of the total:

### October-November-December 1944

<u>Containers Inspected (Wet Only)</u>			<u>Containers Breeding</u>		
<u>Type</u>	<u>No.</u>	<u>% of Total</u>	<u>Type</u>	<u>No.</u>	<u>% of Total</u>
1 Animal Drinking Troughs or Pans	218,818	42.6	1 Others	1,172	25.7
2 Flower Vases, Vine Bowls	83,547	16.3	2 Tin Cans, Pans	883	19.4
3 Barrels, Buckets, Jars, Tubs, Tanks	39,546	7.7	3 Flower Vases, Vine Bowls	555	12.2
4 Tin Cans, Pans	35,430	6.9	4 Lily Plants	527	11.6
5 Others	32,175	6.3	5 Barrels, Buckets, Jars, Tanks, Tubs	466	10.2
6 Bottles	29,063	5.7	6 Bottles	368	8.1
7 Lily Plants	19,749	3.8	7 Ape Plants	207	4.5
8 Fish Ponds	16,423	3.2	8 Ant Cups	163	3.6
9 Ape Plants	15,025	2.9	9 Animal Drinking Troughs or Pans	82	1.8
10 Ant Cups	10,982	2.1	10 Tires	76	1.7
11 Ditches, Ground Pools	6,399	1.2	11 Fish Ponds	39	.9
12 Tires	3,737	.7	12 Ditches, Ground Pools	10	.2
13 Catch Basins	1,874	.4	13 Catch Basins	3	.06
14 Cesspools	443	.1	14 Cesspools	1	.02
Total Containers	513,211		Total Containers	4,552	



As noted in the November 1944 monthly narrative report in the analysis of containers for October-November-December 1943 and July-August-September 1944, the most numerous types of potential breeders are still not the greatest source of mosquito breeding. The importance of other or unusual breeding containers has increased. In line with this trend, emphasis is now being placed upon the location and elimination of hidden and unusual breeders.

Respectfully,

/s/ Arve H. Dahl  
Arve H. Dahl  
P. A. Sanitary Engineer (R)  
i/c Dengue Mosquito Control





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
December 1944

I. Monthly Summary

A. Dengue Fever Cases--Non military

Cases acquired within Territory--0  
Cases "off shipping"--0

B. Control Program--Territorywide (As covered in this report)

No. of premises inspected	61,468
No. of premises breeding <u>Aedes</u>	793
Total personnel engaged in program	192

Regular control activities during the month of December have been limited to the Island of Oahu. On the Island of Hawaii, the second complete monthly school Mosquito Control Day was held on the first Friday of December. Results of this control activity will be found under VI, Public Education, of this report.

II. Control Activities in Honolulu

A. Inspection Activities

The citywide Aedes breeding index in Honolulu was 1.6% on December 15 and 1.2% at the end of December. At the end of December, 10 zones had indexes above 3% and 5 zones had indexes over 5%. Following is a summary of the month's activities:

No. of premises inspected	46,897
No. of premises breeding <u>Aedes</u>	695
<u>Aedes</u> breeding index on December 31	1.2%
No. of inspections per man-day	38.2

## B. Special Work

### 1. Insecticide Spraying

The power sprayer was utilized in spraying 15 premises in the Kapahulu area and 51 premises in the Waikiki area.

### 2. Tree and Rock Hole Filling

One thousand one hundred thirty-three tree holes were filled, of which 53 or 4.6% were breeding. Six hundred forty-five rock holes were filled, of which 21 or 3.2% were breeding and 630 upright pipes were filled.

### 3. Larviciding Activities during December.

The following mosquito breeding places were treated with diesel oil:

storm drains--70  
ground pools--17  
ditches--12  
manholes--12  
cesspools--5  
bomb shelters--4  
gun mount--1  
well--1

The power sprayer was used to larvicide swamp areas in back of Lanakila School, Kalakaua Housing, Church of the Cross-roads, Sheridan Street and Coolidge Street.

### 4. Roof Gutters

The roof gutters on 11 premises were corrected during the month.

### 5. Clean-up Crew

A total of 50 truck loads of containers were collected and hauled away, of which 29 were from the Lanakila district, 15 from the Central district and 6 from the Kapahulu district.

### 6. Fish Stocking

Six fish ponds were stocked with mosquito minnows during December.



## 7. Inspection of USED Base Yards and Waterfront Area

Complete inspections of 23 USED base yards were made.  
Aedes breeding was found 5 times.

Seventy-four complete inspections were made of the waterfront area. No Aedes breeding was found.

## C. Personnel

	<u>Field</u>	<u>Total</u>
Army	74	74
Chamber of Commerce	1	4
U. S. Public Health Service	23	36
TOTAL	98	114

## D. Report of Honolulu Supervisor

Assistant Sanitarian (R) Bertram Gross reports the following:

Phenothiazine strips prepared by the entomological staff are fulfilling a definite need in the control program. Water-proofed pint jars filled with phenothiazine strips were suspended from all water spigots in Nuuanu Cemetery with instructions for their use placed on each jar. Inspections to date show that nearly all visitors to the cemetery are making use of these strips in flower vases and urns, as requested.

Envelopes containing phenothiazine strips have been distributed to certain hotels where interior breeding has been persistent. Each envelope contains twelve phenothiazine strips 1/2" x 1" with instructions as to their use stamped on the envelope. The manager of each hotel was requested to see that the occupant of each room received the strips together with a mimeographed educational form letter bearing the hotel's endorsement of suggestions made for the curtailment of breeding places in water plants and flower vases. To date, results have been excellent, no interior breeding having been found by the inspectors.

Similar envelopes are now being distributed to premise occupants by inspectors in certain critical zones in the Waikiki areas. It is planned to eventually distribute phenothiazine strips throughout the entire city through the zone inspectors.

## E. Chamber of Commerce Expenditures for Calendar Year 1944

During calendar year 1944 the Chamber of Commerce of Honolulu, from its public health funds, expended approximately

\$44,950.00, of which approximately \$35,000.00 was allocated through the Rat and Mosquito Control Committee and \$9,950.00 was allocated through the Public Health Committee, specifically for dengue mosquito control.

The Rat and Mosquito Control Committee budget has been an annual expenditure for combined rat and mosquito control activities and represents primarily expenditures for salaries. However, during the past year approximately \$12,990.00 were made available for gratuities for military personnel assigned to the mosquito control program. The gratuities were distributed according to an approved schedule based on the period of service on the program and the type of duty carried by the individual.

The funds of the Public Health Committee on mosquito control were budgeted for salary items, repair and maintenance of automotive vehicles, printing and other items.

The Public Health Committee and the Board of Directors of the Chamber of Commerce have approved a budget for the first six months of calendar year 1945 in the amount of \$4,300.25, exclusively for dengue mosquito control.

### III. Public Health Service Expenditures for the Quarter Year October-December

<u>Month</u>	<u>Salaries</u>	<u>Supplies and Equipment</u>	<u>Miscellaneous</u>
October	\$8,111.99	\$227.38	\$88.55
November	7,939.50	416.48	
December	<u>7,827.46</u>	<u>353.04</u>	<u>146.49</u>
	23,878.95	996.90	235.04

GRAND TOTAL--\$25,110.89

The grand total for the period July through September was \$22,532.22.

### IV. Wahiawa Program

#### Personnel--4

The citywide Aedes breeding index in Wahiawa was .9% in mid-December and .6% at the end of the month. Following is a summary of the inspection activities for December:

No. of premises inspected	1,679
No. of premises breeding <u>Aedes</u>	13
<u>Aedes</u> breeding index on December 31	.6%
No. of inspections per man-day	31.2



## V. Rural Oahu Program

### Personnel--73

During the last half of November a total of 3,839 premise inspections were made in rural Oahu, of which 26 were found breeding Aedes mosquitoes, giving an Aedes breeding index of .6%. During the month of December a total of 5,214 premises were inspected, of which 33 were found breeding Aedes mosquitoes, giving an Aedes breeding index of .6%. Following is a list of Aedes breeding indexes as of December 31:

<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>	<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>
Aiea	1.2	Pearl City	—
Ewa	—	Waialua	.3
Haleiwa	3.5	Waipahu	.4

All work in rural Oahu has been carried on by the 719th Medical Sanitary Company. Due to a shortage of officers in the company to supervise field operations, it has not been possible to carry on control operations in towns on the windward side of the island.

## VI. Public Education

During the month of December, 45 column inches of English and 25 column inches of foreign language news articles appeared in local papers. In addition, Assistant Sanitarian (R) Wendell R. McCool reports the following concerning the mosquito control educational program on the Island of Hawaii:

Since the start of the coordinated school mosquito control program on the Island of Hawaii, two control days have been reported by the 38 schools participating. The percentage of students reporting results continues to be high with 67% reported in December.

The latest reports for the month of December show that 7,685 students found 5,296 containers, of which 4,628 were breeding, giving a container breeding index of 30.3%. This represents a 25% reduction in the number of containers found and over 30% decrease in the number of containers found breeding since the first report in November. This program is carried on by the students after school hours and reports inspections of their own homes and yards. In making the inspections, the students are instructed to destroy or remove all containers in order to eliminate future trouble. Succeeding control days are expected to

show a further decrease, both in numbers of containers found and the amount of breeding taking place.

## VII. Entomological Work

The following material is abstracted from the reports of Assistant Sanitarian (R) David D. Bonnet:

### 1. Experiments with DDT

Certain experiments in the use of DDT have been performed and many others are projected. The emphasis has been upon the use in local control problems rather than a duplication of experiments performed in other areas. Since one of the biggest control problems in the Hawaiian Islands involves the control of breeding in lily plants, ape plants and tree holes, it is necessary to find a method of treating these plants which will not harm the plants but will give lasting control. The high toxicity of DDT in low concentrations promises to be a possible solution. Tests are therefore being done on the effect of different concentrations on local vegetation involved in mosquito breeding.

### 2. Preparation of Phenothiazine Strips

The laboratory has undertaken the preparation of phenothiazine strips for the use of the control program. The method of preparation has been a modification of that used in other areas and has proven satisfactory. The formulae used in the preparation is as follows:

1 lb. phenothiazine (Thiodiphenylamine)  
1/2 oz. clear gelatin  
1/4 oz. Vatsol  
Sufficient water to liquify and to paint.

This quantity is sufficient to make up approximately 9,000 square inches or 18,000 strips (1/2" x 1"). Each strip has an approximate dosage of 0.025 gram. One strip placed in a quart of water would give an approximate dosage of one to 40,000 if all phenothiazine were to go into the solution. It is questionable if the concentration ever reaches more than one to 60,000.

### 3. Minimum Amount of Water to Support Aedes Albopictus Larvae Development.

It has been claimed that mosquito larvae, under conditions where a minimum amount of water is present in the container, can complete their life cycle and emerge. To test this statement,



twelve Aedes albopictus larvae of various instars were placed under observation in a covered Petri dish, 3-1/2" in diameter. The dish contained a layer of four pieces of filter paper saturated with water and several chopped leaves of nut grass. Two days after introduction the larvae were all alive; most of them had wriggled under the leaves or into the folds of the top filter paper where slightly more water was available. On the third day, one larva pupated but died and three managed to molt. By the fourth day four larvae had pupated and all but one died. This pupa alone survived and it emerged as a male one week from the start of the experiment.

It would seem that tree holes, containing a water-saturated mass of leaves and trash and but a few cubic centimeters of water, are capable of supporting the albopictus life cycle.

#### VIII. Miscellaneous

##### A. The Effects of Variations in Rainfall on Mosquito Breeding Indexes

Over a period of one year, a study has been made of the Aedes breeding indexes in fifteen zones located in the vicinity of ten of Honolulu's rainfall stations. The rainfall stations are located at various points throughout the city in such a manner as to give a wide variance in seasonal and annual rainfall.

In general, the following observations have been made:

- (1) Higher breeding exists in areas of greatest rainfall.
- (2) Small and sometimes moderate increases in rainfall have not greatly affected the Aedes breeding index.
- (3) One week of high rainfall preceeded and followed by low rainfall has not seriously affected mosquito breeding.
- (4) Three or four weeks of moderate to high rainfall usually have produced an increase in mosquito breeding.
- (5) Areas which normally had low rainfall have not shown proportionate increases in Aedes breeding after a period of higher rainfall, as had areas of normally high rainfall.

##### B. Personnel

P. A. Sanitary Engineer (R) Arve H. Dahl reported during the latter part of the month to replace P. A. Engineer (R) Wesley

E. Gilbertson, who is returning to the Headquarters Office of Malaria Control in War Areas in Atlanta, Georgia for reassignment.

A continued shortage of inspection personnel, both civilian and military, has lengthened the average inspection cycle to about three weeks.

Respectfully,

/s/ Arve H. Dahl  
Arve H. Dahl  
P. A. Sanitary Engineer (R)  
i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
November 1944

I. Monthly Summary

A. Dengue Fever Cases--Non-military

Cases acquired within Territory--0  
Cases "off shipping"--0

B. Control Program--Territorywide (As covered in this report)

No. of premises inspected	83,028
No. of premises breeding <u>Aedes</u>	958
Total personnel engaged in program	199

II. Control Activities in Honolulu

A. Inspection Activities

The citywide Aedes breeding index in Honolulu was 1.0% on November 15 and 1.2% at the end of November. Thus it has remained in the neighborhood of 1% since the middle of September. At the end of November, 11 zones had indexes above 3% and 4 zones had indexes over 5%. Following is a summary of the month's activities:

No. of premises inspected	68,428
No. of premises breeding <u>Aedes</u>	775
<u>Aedes</u> breeding index on November 30	1.2%
No. of inspections per man-day	41.1

B. Special Work

1. Insecticide Spraying

The power sprayer was utilized in spraying Dewey Court and a portion of the Niunalu Hotel in the Waikiki area.

2. Tree and Rock Hole Filling

One thousand three hundred eighty tree holes were filled, of which 47 or 3.4% were breeding, 358 rock holes were filled, of which 12 or 3.3% were breeding and 555 upright pipes were filled.

### 3. Larviciding Activities during November

The following mosquito breeding places were treated with diesel oil:

storm drains--55  
manholes--12  
ground pools--10  
ditches--7  
cesspools--4  
bomb shelters--2

The power sprayer was used to larvicide swamp areas on Sheridan Street and near Kalaaukalini Way.

### 4. Roof Gutters

The roof gutters on 17 premises were corrected during the month.

### 5. Clean-up Crew

A total of 106 truck loads of containers were collected and hauled away, of which 27 were from the Lanakila district, 10 from the Central district and 6 from the Kapahulu district. Five hundred thirty-one old tires were disposed of.

### 6. Fish Stocking

Eight fish ponds were stocked with mosquito minnows during November.

### 7. Inspection of USED Base Yards and Waterfront Area

Thirty-five complete inspections of USED base yards were made. Aedes breeding was found in eight containers located on five different yards.

Seventy-eight complete inspections were made of pier and dock areas. Aedes breeding was found once.

## C. Personnel

	<u>Field</u>	<u>Total</u>
Army	77	77
Chamber of Commerce	2	5
U. S. Public Health Service	26	40
TOTAL	105	122



#### D. Report of Honolulu Supervisor

Assistant Sanitarian (R) Bertram Gross, who was designated as Supervisor of the Honolulu mosquito control program recently, reports the following:

Observations made during the period September 6 to November 30, 1944 revealed (1) a need for more adequate and constant supervision of zone inspectors, special crew workers and foremen, (2) that more intensive inspections and corrective measures are indicated for certain well-defined areas where Aedes breeding has occurred consistently over extended periods of time.

To date, various changes have been made in field procedures, chief of which follow:

(1) Referral slips covering special situations, which were formerly handled by the foremen, are now followed up by special crews or by the district supervisor.

(2) Foremen have been instructed to be in the field at all times, assisting, instructing and correcting zone inspectors.

(3) Assistant foremen work as zone inspectors, assuming a supervisory capacity only when the foreman is absent.

(4) A foreman and his crew now work as a group in one zone. When that zone has been completed the men move as a unit to the next zone in the assigned territory. In this manner it is possible for the foreman to maintain closer supervision of his men. Formerly each zone was assigned to a single inspector.

(5) Foremen are being checked daily as to their efficiency and competency.

(6) Special Crew foremen are required to turn in a daily route sheet each morning.

(7) The nucleus of a "Mother Foci" squad has been established and will be expanded. "Mother Foci" is a term applied to a well-hidden breeding place which is continuous, and thus "seeds" the area with mosquitoes. These mosquitoes find their way to miscellaneous temporary breeding containers.

#### III. Public Education

During the month of November, 94 column inches of English and 50 column inches of foreign language news articles appeared in local

papers. In addition, Assistant Sanitarian (R) Wendell R. McCool reports the following concerning the educational program on the Island of Hawaii:

In cooperation with Mr. Oren E. Long, Superintendent of the Department of Public Instruction and Mr. Tate Robinson, Director of Health Education for the same department, arrangements were completed for a coordinated school mosquito control program in the schools on the Island of Hawaii.

Conferences were arranged by the County Health Officer with the three supervising principals on Hawaii and with representatives of the private schools. A total of 38 schools were included in the program with 10 more to be added when the coffee picking season on the Kona side of the Island is completed. One day each month, the first Friday for most schools, is being designated as "Mosquito Control Day." A report form has been prepared on which the students record the number of water-filled containers discovered around their own homes and yards and also the number found which contain mosquito wrigglers.

Totals are tabulated by room and by school and forwarded to the Health Officer on the Island for final tabulation. The results of the first after-hours inspection by the students of these schools show that over 70% of the students reported; that over 20,000 water-filled containers were eliminated; and that more than one-third of them contained mosquito wrigglers.

To inaugurate the program, the schools were visited by two members of the dengue control staff. The students from the fourth grade and up were assembled and an explanation given of the program for controlling the day mosquito. The life cycle and potential breeding places of the dengue carrier were covered.

Two 15-minute radio programs and 12 spot announcements over the local radio station were sponsored by the Hilo Chamber of Commerce during the 10-day promotional period. At a later date the 10 schools now closed will be visited and the program outlined to the students.

Results of the first Mosquito Control Day are very satisfactory and reflect a fine spirit of cooperation on the part of the students of Hawaii.

#### IV. Wahiawa Program

##### Personnel--4

The citywide Aedes breeding index in Wahiawa was 0.8% in mid-November and 2.3% at the end of the month. One of the three



inspectors was unable to work during a major portion of the month. Following is a summary of the inspection activities for November:

No. of premises inspected	2,029
No. of premises breeding <u>Aedes</u>	31
<u>Aedes</u> breeding index on November 30	2.3%
No. of inspections per man-day	39.2

Towards the end of the month the clean-up crew from the 719th Medical Sanitary Company took care of a large accumulation of referral slips covering clean-up activities throughout the city.

## V. Kauai Program

Personnel--40

The 719th Mosquito Control Detachment was transferred from Kauai during November. During the first half of the month a total of 7,191 premise inspections were made, on which 125 were found breeding Aedes mosquitoes. Following is a list of Aedes breeding indexes as of the termination of the active control work on Kauai:

<u>Aedes Breed</u>		<u>Aedes Breed</u>	
<u>Town</u>	<u>Index</u>	<u>Town</u>	<u>Index</u>
Eleele	1.1	Koloa	3.8
Hanalei	8.1	Koloa Mill	-
Hanamaulu	.8	Lihue	2.8
Hanapepe	.7	Makaweli	.5
Huleia Camp 3	2.1	Nawiliwili	3.2
Kalahoe	.6	Port Allen	1.2
Kapaa	.5	Puhi	2.6
Kapaia	2.9	Wahiawa	.2
Kealia	1.4	Wahiawa Camp 2	.7
Kekaha	.4	Waimea	.9
Kilauea	2.9		

When control activities began on Kauai, the indexes ranged up to approximately 30%, with an island-wide average of approximately 15%. In the above summary it will be noted that the community with the highest index in mid-November was Hanalei with 8.1%, the next highest was Koloa with 3.8%. During the last period only 1.7% of all premises inspected on Kauai were found to have Aedes breeding. Efforts are being made to urge the general public to maintain low mosquito breeding conditions as they now exist. Newspaper articles to that effect have been published and possibly a school program may be inaugurated later.

## VI. Rural Oahu Program

### Personnel--73

During the first half of November a total of 5,380 premise inspections were made in rural Oahu, of which 27 were found breeding mosquitoes.

Following is a list of the Aedes breeding indexes on November 15:

<u>Aedes Breed</u>		<u>Aedes Breed</u>	
<u>Town</u>	<u>Index</u>	<u>Town</u>	<u>Index</u>
Aiea	.2	Laie	3.5
Ewa	.3	Pearl City	.2
Haleiwa	-	Waialua	.6
Kahuku	-	Waimanalo	.7
Kaneohe	1.4	Waipahu	-
Kailua	.7		

## VII. Entomological Work

The following material is abstracted from the reports of Assistant Sanitarian (R) David D. Bonnet.

### 1. Pyrethrum Spray Tests

A series of tests were conducted to determine the effectiveness of various mixtures of pyrethrum extract in the Milwaukee sure-shot sprayers as used on the program. Conditions were set up so as to closely approximate normal conditions in spraying a house. In a room with a volume of 1,750 cubic feet, with a spraying time of 5 to 6 seconds, the following concentrations were found satisfactory:

	<u>Amount of</u> <u>Pyrocide 20</u>	<u>Amount of</u> <u>Kerosene</u>	<u>Amount of</u> <u>Liquid Gas</u>
Trial 1	300 cc.	0	12 oz.
3	100 cc.	200 cc.	12 oz.
4	150 cc.	150 cc.	12 oz.

In trial 2 with 75 cc. of Pyrocide 20 and 225 cc. kerosene, a satisfactory kill was not achieved with 6 seconds spraying time, but when this was increased to 10 seconds it was satisfactory.

Observations were made at 5 minutes after spraying at which time the cages were removed to another room. Additional observations were made at 15 minutes and at 24 hours.



## 2. Hybridization

From time to time various authors have reported attempts to cross different species of mosquitoes. In only a few of these attempts have successful crosses been reported. Weyer (1936) and Roubaud (1941) successfully crossed Culex pipiens with Culex quinquefasciatus. Toumanoff (1937) (1930) reported successful crosses between Aedes aegypti and Aedes albopictus in Indo-China while attempts to cross Aedes albopictus from Calcutta with Aedes aegypti from Indo-China were unsuccessful. Similarly, Simmons, St. John and Reynolds (1930) were unsuccessful in crossing these species with races from the Philippines. Hoang Tich Try (1939) reported that male aegypti and female albopictus crossed readily in small cages and at unfavorable times of the year. All the progeny resembled albopictus. Connall (1925) attempted to cross breed Aedes aegypti with Aedes luteocephalus and Aedes longipalpus in Africa but with negative results.

Attempts to cross Aedes aegypti females and Aedes albopictus males have been successful in Honolulu in two instances and all the offspring through two generations have resembled Aedes aegypti. The fact that both males and females are produced by this cross, would indicate that this is not a case of parthenogenesis, if sex is determined in mosquitoes by a chromosome mechanism similar to that shown for Drosophila. Furthermore, since the  $F_1$  generation is fertile, it would seem to indicate that the different chromosomes are compatible. In order to demonstrate the existence of true hybrids, slides are being prepared of the  $F_1$  larvae and of the salivary gland of adult  $F_1$  and of aegypti and albopictus females and males. If there is an obvious difference in size or shape of the chromosomes in the two species the difference should be demonstrable in the hybrids. Furthermore, back crosses between the hybrids and the species of the male parent should bring out the presence of such chromosomes.

Male terminalia are being prepared in the hope that there will be observable differences in the hybrid condition. Double-screened cages were used.

## 3. Flight Range of Albopictus

The studies of the flight range of Aedes albopictus are practically complete and it is now planned to review and analyze the data collected. A report will be made of the results.

## 4. Oviposition Requirements of Aedes albopictus

From time to time it has been suggested that the large hordes of Aedes albopictus that are found in the rain forest perhaps

do not need a blood meal in order to lay eggs. A test of Aedes albopictus females in the laboratory indicates that a blood meal is required for oviposition. No eggs were obtained from females fed on raisins or sugar water, whereas females given a blood meal readily laid eggs. Fertilization by a male is not necessary for oviposition and females, which were given a blood meal but were isolated from males, laid eggs which were sterile.

VIII. Analysis by Type of Containers Inspected and Containers Found Breeding Aedes in Honolulu

Following is an analysis of the various types of actual and potential Aedes breeding places ranked according to importance and showing the percentage which each type of container assumes of the total. For comparison, the figures for the period October-November-December 1943 and the figures for the period July-August-September 1944 are shown.

October-November-December 1943

<u>Containers Inspected (Wet &amp; Dry)</u>			<u>Containers Breeding</u>		
<u>Rank</u>	<u>Type</u>	<u>% of Total</u>	<u>Rank</u>	<u>Type</u>	<u>% of Total</u>
1	Bottles	36.0	1	Lily Plants	23.8
2	Tin Cans, Pans	15.2	2	Tin Cans, Pans	15.1
3	Lily Plants	13.1	3	Bottles	12.7
4	Ape Plants	10.7	4	Flower Vases	
5	Barrels, Buckets,			Vine Bowls	11.4
	Jars, Tubs, Tanks	7.0	5	Barrels, Buckets,	
6	Flower Vases,			Jars, Tubs, Tanks	10.5
	Vine Bowls	5.2	6	Ape Plants	7.2
7	Animal Drinking		7	Others (misc.)	6.2
	Troughs or Pans	4.8	8	Ant Cups	6.0
8	Others (misc.)	2.3	9	Tires	2.5
9	Tires	2.1	10	Animal Drinking	
10	Ant Cups	1.6		Troughs or Pans	1.5
11	Fish Ponds	0.7	11	Fish Ponds	1.1
12	Ditches, Ground		12	Catch Basins	1.1
	Pools	0.6	13	Ditches, Ground	
13	Catch Basins	0.6		Pools	0.8
14	Cesspools	0.1	14	Cesspools	0.1
	TOTAL	100.0		TOTAL	100.0



July-August-September 1944

<u>Containers Inspected (Wet Only)</u>			<u>Containers Breeding</u>		
<u>Rank</u>	<u>Type</u>	<u>% of Total</u>	<u>Rank</u>	<u>Type</u>	<u>% of Total</u>
1	Animal Drinking Troughs or Pans	47.8	1	Others (misc.)	19.5
2	Flower Vases, Vine Bowls	19.7	2	Flower Vases, Vine Bowls	17.3
3	Barrels, Buckets, Jars, Tanks, Tubs	6.9	3	Lily Plants	16.2
4	Ape Plants	4.7	4	Tin Cans, Pans	11.6
5	Tin Cans, Pans	4.4	5	Barrels, Buckets, Jars, Tanks, Tubs	10.4
6	Lily Plants	4.2	6	Bottles	8.2
7	Others (misc.)	3.6	7	Ant Cups	6.3
8	Bottles	3.2	8	Ape Plants	6.3
9	Ant Cups	2.3	9	Animal Drinking Troughs or Pans	1.8
10	Fish Ponds	1.2	10	Tires	1.1
11	Ditches, Ground Pools	0.9	11	Fish Ponds	0.71
12	Catch Basins	0.5	12	Ditches, Ground Pools	0.31
13	Tires	0.5	13	Catch Basins	0.25
14	Cesspools	0.1	14	Cesspools	0.03
TOTAL		100.0	TOTAL		100.0

It will be noticed that the most numerous types of potential breeders are not the greatest sources of mosquito breeding. A comparison of the two sets of figures also shows that control activities produce a differential effect in that useless containers are eliminated as sources of mosquito breeding more easily than the semi-useful, useful and decorative containers. Interior breeding places are also difficult to reduce.

A study of the two quarter-year periods between those mentioned above, shows that a gradual change has been taking place, in which the types of containers at the top of the lists were reduced and succeeded usually by the next most numerous types.

Respectfully,

/s/Wesley E. Gilbertson  
Wesley E. Gilbertson  
P. A. Engineer (R)  
i/c Dengue Mosquito Control





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
October 1944

I. Monthly Summary

A. Dengue Fever Cases--Non-military

Cases acquired within Territory--2  
Cases "off shipping"--0

B. Control Program--Territorywide (As covered in this report)

No. of premises inspected	108,705
No. of premises breeding <u>Aedes</u>	1,261
Total personnel engaged in program	241

II. Control Activities in Honolulu

A. Insecticide Spraying

Houses sprayed--1  
Garages sprayed--1

B. Inspection and Indexes

The citywide Aedes breeding index in Honolulu was 1.0% on October 15 and 1.1% at the end of October. The increase took place in the Central and Kapahulu districts. Four zones had indexes over 3% and two zones had indexes over 5% at the end of the month. Following is a summary of the month's activities:

No. of premises inspected	77,516
No. of premises breeding <u>Aedes</u>	877
<u>Aedes</u> breeding index on October 31	1.1%
No. of inspections per man-day	43.3

C. Special Crews

1. Trouble Shooting Crew

Insecticide spraying activities were minor during the month of October. Tree holes filled numbered 2,488, of which 92 or 3.7% were found breeding. Rock holes filled numbered

2,290, of which 178 or 7.7% were found breeding. When the tree and rock hole filling activities were inaugurated about ten months ago it was found that the tree holes had a higher percentage of breeding than the rock holes. However, during the past month the reverse was true. Upright pipes in the ground which were filled numbered 496.

## 2. Larviciding activities during October

The following mosquito breeding places were sprayed with diesel oil:

- storm drains--28
- ditches--7
- cesspools--6
- streams--3
- ground pools--3
- manholes--1
- bomb shelters--2

Larviciding activities were covered principally by knapsack sprayers, with the exception of a swampy area along Kapiolani Boulevard, for which a power sprayer was used.

## 3. Clean-up Activities

A total of 61 truck loads of miscellaneous containers were removed by the clean-up crew in covering 154 referrals. These were divided among the districts as follows: Central--52, Kapahulu--42 and Lanakila--23.

In a program inaugurated in October to eliminate useless old tires, a total of 1,548 tires were disposed of. In each case the serial number of the tire was recorded and the signature of the householder obtained on the referral slip.

## 4. Fish Stocking

Eleven fish ponds were stocked with mosquito minnows during the month of October.

## 5. Inspections of USED Base Yards and Waterfront Area

Twenty-seven inspections were made of USED base yards. Aedes breeding was found 9 times on 5 yards. Culex breeding was found 9 times on 6 yards.

Seventy-four inspections were made of docks and piers in the waterfront area. Aedes breeding was found 4 times on 3 piers and Culex breeding was found 10 times on 4 piers.



Under the direction of the Medical Officer of the Base Command Construction Department, a responsible individual has been designated at each base yard to correct mosquito breeding conditions. The responsible person is to check the yards between inspections by the mosquito control inspector and will accompany the inspector when the check inspection is made.

#### D. Personnel

	<u>Field</u>	<u>Total</u>
Army	77	77
Chamber of Commerce	2	5
U. S. Public Health Service	<u>29</u>	<u>42</u>
TOTAL	108	124

Since the activation of the 114th Medical Service Company (San.), several of the army personnel previously assigned to mosquito control duty have been released for duty at the company headquarters. This reduces the number of army personnel assigned to the work in Honolulu the lowest since last October. It is anticipated that additional manpower will be assigned to the company soon for mosquito control duty.

#### E. Public Education

During October plans were made for the inauguration of an extensive mosquito education program on the Island of Hawaii to be conducted through the public schools. The program was arranged in cooperation with the Department of Public Instruction through Mr. Oren E. Long, Superintendent, Department of Public Instruction, Mr. Tate Robinson, Director of Health Education and the Supervising Principals on the Island of Hawaii, Mrs. Emma P. Giacometti and Messrs. Cecil K. Dotts and Ernest de Silva. Various educational materials were reproduced in quantity for distribution to the teachers and students.

In Honolulu 33 column inches of English and 16 column inches of foreign language news appeared in local newspapers during October.

#### F. Refuse Collection Plan for Piggeries in the Kapahulu District

Since the inauguration of mosquito control, some difficulty has been experienced because of mosquito breeding conditions in the vicinity of piggeries located in the Kapahulu district of Honolulu. The accumulations of tin cans and other receptacles are excessive at these establishments because the hog raisers collect garbage from food handling establishments throughout the city for hog feed. The City-County Refuse Collection

Department has not provided refuse collection at these establishments because of the excessive accumulations and because they are located on private roads.

In cooperation with the sanitation supervisor, a plan has been worked out whereby the area is divided into four sections: upper Oili, lower Oili, Kahala and Kapakahi. In a meeting with the hog raisers it was decided that one or two individuals would be responsible for collection of garbage and refuse once a month for each section. For each section individual arrangements were worked out concerning assessing the various participants in the plan.

By arrangement with the City-County refuse disposal plan the usual dumping fee has been waived so that the piggeries may dispose of these accumulations without charge.

III. Public Health Service Expenditures for the Quarter Year July-September

<u>Month</u>	<u>Salaries</u>	<u>Supplies &amp; Equipment</u>
July	\$6,107.66	
August	8,493.32	\$344.76
September	<u>7,233.21</u>	<u>353.27</u>
	\$21,834.19	\$698.03
GRAND TOTAL--\$22,532.22		

The grand total for the period April 1 through June 30, 1944 was \$26,244.91.

IV. Wahiawa Program

Personnel--4

The Wahiawa citywide Aedes breeding index was 1.1% in mid-October and 1.3% at the end of the month. Following is a summary of the inspection activities for the month of October:

No. of premises inspected	2,442
No. of premises breeding <u>Aedes</u>	32
<u>Aedes</u> breeding index on October 31	1.3%
No. of inspections per man-day	47.2

During October lily plants were the most numerous type of Aedes breeder. Next were interior breeders (flower vases and vine bowls) and miscellaneous large containers (barrels, tubs, tanks, jars, buckets).



## V. Kauai Program

Personnel--40

During the period September 16 through October 31 a total of 18,745 premises were inspected on the Island of Kauai. Of these, 298 were found to be breeding Aedes mosquitoes. Following is a list of the Aedes breeding indexes as of October 31:

<u>Aedes Breed</u>		<u>Aedes Breed</u>	
<u>Town</u>	<u>Index</u>	<u>Town</u>	<u>Index</u>
Eleele	-	Koloa	1.7
Hanalei	5.0	Koloa Mill	-
Hanamaulu	1.6	Lihue	3.1
Hanapepe	-	Makaweli	.9
Huleia Camp 3	1.0	Nawiliwili	4.8
Kalaheo	2.6	Port Allen	-
Kapaa	.5	Puhi	-
Kapaia	1.1	Wahiawa	-
Kealia	.9	Wahiawa Camp 2	1.4
Kekaha	.6	Waimea	1.6
Kilauea	2.8		

Additional work reported from Kauai included the weekly spraying of ditches and ground pools which were breeding Culex mosquitoes in the vicinity of an army hospital; a ditch at Hanapepe and spotty breeding areas in the area where the detachment is quartered. A ground pool in Waimea was filled, requiring 18 truck loads of sand. A taro patch in Waimea was stocked with mosquito fish.

## VI. Rural Oahu Program

Personnel--73

During the month of October a total of 10,002 premise inspections were made in rural Oahu communities on which 54 were found breeding Aedes. Work was reinaugurated in windward Oahu communities during the month. During the last half of October one-half of all breeding containers were found to be in the miscellaneous large container group (barrels, tubs, tanks, jars, buckets). The next most numerous breeder was interior containers such as flower vases and vine bowls.

Following is a summary of the Aedes breeding indexes as of the end of the month:

<u>Aedes Breed</u>		<u>Aedes Breed</u>	
<u>Town</u>	<u>Index</u>	<u>Town</u>	<u>Index</u>
Aiea	.1	Laie	4.4
Ewa	.2	Pearl City	.1
Haleiwa	.5	Waialua	.6
Kahuku	-	Waimanalo	-
Kaneohe	1.1	Waipahu	.3

Respectfully,

/s/Wesley E. Gilbertson  
Wesley E. Gilbertson  
P. A. Engineer (R)  
i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
September, 1944

I. Monthly Summary

A. Dengue Fever Cases

Cases acquired within Territory--3 (civilian)  
Cases "off shipping"--1 (civilian)

B. Control Program--Territorywide (As covered in this report)

Number of premises inspected	123,843
Number of premises breeding Aedes	1,444
Total personnel engaged in program	305

II. Control Activities in Honolulu

A. Insecticide Spraying

Houses sprayed--26  
Garages sprayed--8  
Others--2

B. Inspection and Indexes

The citywide Aedes breeding index in Honolulu was 0.4% on September 15 and 1.0% at the end of the month. The increase in mosquito breeding was general over the whole city but relatively higher in the Lanakila district. Seven zones had indexes over 3% and 2 zones had indexes over 5% at the end of the month. Following is a summary of the month's activities:

No. of premises inspected	79,369
No. of premises breeding Aedes	604
Aedes breeding index on September thirtieth	1.0%
No. of inspections per man-day	47.2

## C. Special Crews

### 1. Trouble Shooting Crew

In addition to insecticide spraying activities, the trouble shooting crew filled 2,088 tree holes with cement, of which 13 or 0.4% were breeding, 243 rock holes, of which 34 or 1.4% were breeding and 29 upright pipes.

### 2. Larviciding activities during September included 61 storm drains, 14 ditches, 10 cesspools, 6 swamp areas, 4 streams, 2 bomb shelters and one swimming tank.

### 3. Roof Gutter Work

The gutters of 159 residences were inspected, of which 68 were cleaned, 12 repaired, 6 perforated and one removed. Four roof gutters were found breeding Aedes mosquitoes.

### 4. Clean-up Activities

Sixty-three truck loads of miscellaneous containers were removed from 135 premises. About two-thirds of the work was done in the Central district.

### 5. Fish Stocking

Nine fish ponds and 7 ground pools were stocked with mosquito minnows.

### 6. During September, 74 inspections were made on docks, piers and buildings on the waterfront area and 48 inspections were made of USED base yards. Aedes mosquitoes were found breeding four times in the waterfront area and ten times in the USED base yards.

This information was forwarded each time to the responsible persons in charge. A special effort is being made by the Medical Department of USED to take care of their problem.

## D. Personnel

	<u>Field</u>	<u>Total</u>
Army	84	84
Chamber of Commerce	4	7
U S Public Health Service	27	40
TOTAL	<u>115</u>	<u>131</u>



#### E. Public Education

Seventy-five column inches of English and 37 column inches of foreign language news appeared in local newspapers during September.

#### F. New Supervisor of Honolulu Program

Effective September 20, Assistant Sanitarian (R) Bertram Gross was designated as supervisor of the Honolulu mosquito control program. He is responsible for general supervision of the work, including direction, assignment and training of personnel, selection of equipment and allocation of automotive vehicles. Prior to coming to Honolulu, Mr. Gross was supervisor of the Aedes control program at Key West, Florida and larer general supervisor of the Aedes control work in the State of Florida.

With respect to the supervisory setup, Mr. F. K. Lee continues to be Field Supervisor, R. Mikuni, assistant and the supervisors of the district offices are S. Imada, Kapahulu, T. Mukaida, Central and N. Takamura, Lanakila.

#### G. Mosquito Control Sanitation Company Activated

On September 23, 1944, military personnel assigned to mosquito control and sanitation duty in Honolulu and Wahiawa with the Board of Health became members of the 114th Medical Service Company (Sanitary). This action provides a table of organization for the personnel as well as permitting formal company organization. Lt. C. J. Brett is commanding officer and 2nd Lts. W. C. Downey and W. B. Connearney are the junior officers.

### III. Wahiawa Program

#### Personnel--4

The Wahiawa citywide Aedes breeding index was 0.5% in mid-September and 0.7% at the end of the month, following the same trend as Honolulu. Following is a summary of the inspection activities for the month of September:

No. of premises inspected	2,325
No. of premises breeding Aedes	15
Aedes breeding index on September 30	0.7%
No. of inspections per man-day	44.6

### IV. Kauai Program

#### Personnel--40

During the period August 16 through September 15 a total of 13,400 premises were inspected on the Island of Kauai. Of these , 180 were

found to be breeding Aedes mosquitoes. Following is a list of the Aedes breeding indexes as of September 15, 1944:

<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>	<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>
Eleele	--	Huleia Camp 3	1.0
Hanalei	4.6	Kalaheo	--
Hanamaulu	--	Kapaa	.6
Hanapepe	.4	Kapaia	2.4
Kealia	3.3	Makaweli	--
Kekaha	.2	Nawiliwili	1.0
Kilauea	1.4	Port Allen	--
Koloa	1.2	Puhi	--
Koloa Mill	--	Wahiawa	--
Lihue	2.8	Camp 2	--
		Waimea	1.4

Because of the cooperation of Kauai residents the clean-up phase of the control program has been considerably reduced. Larviciding for Culex control has been done regularly in some areas and intermittently as necessary in other places. At Kapaa and Waimea rather extensive Culex breeding areas exist due to swampy areas in and around these cities.

#### V. Hawaii Program

##### Personnel--57

Effective September 23, 1944, Army personnel who had been conducting mosquito control on the Island of Hawaii were withdrawn for service elsewhere. Control activities had been operating in selected cities on this Island since March 16, 1944 and the excellent work done is reflected in the fact that the Islandwide Aedes breeding index was reduced from 8.2% to 2.6% during the period of control.

One of Hawaii's breeding hazards not encountered extensively elsewhere in the Hawaiian Islands was the presence of hundreds of cisterns upon which the residents in some communities depend for their water supply. A widespread fish-stocking program was inaugurated and carried through to a successful conclusion.

In the period covered, 115,823 inspections of premises were made and Aedes breeding was found in 4,484 instances. During the same period 605,159 containers of all kinds were inspected and eliminated as potential mosquito breeding places. There have been no recent locally-acquired dengue cases on the Island of Hawaii, though "off-shipment" cases have been reported. Intermittent survey inspections are planned for this Island in order to check the extent of mosquito breeding.



A widespread educational program is being prepared to urge the residents of Hawaii to cooperate in maintaining their premises free from *Aedes* breeding.

During the period August 16 through September 23 (previously unreported) 21,202 premise inspections were made, of which 635 were found breeding *Aedes*.

Following is a tabulation of *Aedes* breeding indexes on Hawaii at the time of the last inspection for each city:

<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>	<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>
Hakalau	1.6	Mt. View	6.0
Hilo	1.8	Ninole	1.7
Honohina	1.1	Olaa	6.3
Honokaa	2.3	Paauilo	3.0
Honolulu	1.9	Pahoa	10.0
Kailua	1.7	Papaaloa	2.2
Kamuela	8.3	Papaikou	3.2
Kealahou	7.1	Pepeekeo	2.3
Kukui	9.0		

#### VI. Rural Oahu Program

Personnel--73 (part time)

During the month of September, 7,118 premise inspections were made in rural Oahu communities on which ten were found breeding *Aedes*. No *Aedes* larvae were found in Aiea, Haleiwa, Pearl City or Waialua during September. Following is a summary of *Aedes* breeding indexes as of the end of the month:

<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>	<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>
Ewa	--	Laie	1.9
Kahuku	--	Waipahu	.3

#### VII. Entomological Data of General Interest from the Reports of Assistant Sanitarian (R) David D. Bonnet

##### A. Breeding Habits--Distribution

It has been noted that *Aedes albopictus*, although breeding in artificial containers, also breeds in large numbers in natural containers. In order to compare the breeding habits of *Aedes*

albopictus and Aedes aegypti, 500 larval specimens of each species were selected at random and compared with respect to type of container in which they were found. There is presented herewith lists showing the percentage of the total samples which were found in each type of container, given in descending rank for Aedes albopictus. Also for comparison, a similar list is given for Culex quinquefasciatus based on 346 samples.

<u>Containers</u>	<u>Aedes</u> <u>albopictus</u>	<u>Aedes</u> <u>aegypti</u>	<u>Culex</u> <u>quinquefasciatus</u>
Flower vases	18.2%	15.2%	4.3%
Lily plants	15.8	2.4	0.8
Vine bowls	10.2	5.8	4.3
Tin cans	8.0	10.4	15.0
Ant Cups	6.2	7.2	0.0
Tree holes	6.0	2.0	0.0
Bottles	5.6	11.4	0.3
Pans	4.4	5.6	2.6
Ape plants	4.0	3.6	0.0
Barrels	3.8	2.2	6.9
Buckets	3.8	11.8	10.4
Jars	3.2	0.2	1.4
Tires	2.6	2.0	0.6
Rock holes	2.2	1.0	0.3
Pipes	1.2	1.0	1.4
Ground Pools	0.8	0.0	14.8
Bamboo	0.6	0.0	0.0
Plumbing Fix.	0.6	0.0	0.0
Troughs	0.6	7.0	3.8
Tubs	0.4	5.0	5.1
Fish ponds	0.4	0.4	6.1
Storm drains	0.4	0.0	7.2
Tarpaulins	0.2	0.0	0.0
Tanks	0.2	1.8	0.0
Catch basins	0.2	4.0	3.8
Water Coolers	0.2	0.0	0.0
Boats	0.2	0.0	1.7
Bird Baths	0.2	0.0	0.0
Cesspools	0.0	0.0	1.7
Water meters	0.0	0.0	1.7
Water fountains	0.0	0.0	.6
Concrete struc.	0.0	0.0	1.7
Ditches	0.0	0.0	5.1
Miscellaneous	0.0	0.0	.3

According to the above, 26.6% of the Aedes albopictus samples were taken from natural containers, i. e., tree holes, rock holes, lily plants, ape plants and bamboo, whereas for Aedes



aegypti only 9% of the samples came from this type of container. Aedes albopictus shows a greater percentage in the following container types: flower vases, lily plants, vine bowls, tree holes, jars, barrels and rock holes. Aedes aegypti shows a greater percentage in the following container types: tin cans, ant cups, bottles, pans, buckets, troughs, tubs, tanks and catch basins. For other containers there was a difference of 1% or less between the two species. Lily plants were more important as mosquito breeders than ape plants in the case of Aedes albopictus, whereas Aedes aegypti breeds almost as often in one as in the other, with a slight preference for the ape plant. Albopictus is rarely found in catch basins, while 20 of the 500 samples of aegypti were found in such containers.

#### B. Flight Range of Aedes albopictus

In the studies on the flight range of Aedes albopictus, hand catching has been used because traps have been found not to capture the local Aedes mosquitoes in quantity. During the months of August and September a total of 3,531 marked mosquitoes were released. The dusting method of Clarke (1934) has been utilized with the various dyes mixed with flour. Each week mosquitoes marked with a different color are released.

The total number of mosquitoes captured has been 4,084. Of these, 153 were marked, giving a recovery of marked mosquitoes of 4.3%. Some of these mosquitoes were recaptured at the point of release in order to ascertain dispersal. The other capture stations are located at various distances from the point of release, ranging from 25 yards upwards. The maximum distance that a marked mosquito is known to have traveled is 450 yards (upwind). The maximum time of recovery of marked mosquitoes has been 27 days after date of release. This work will continue until sufficient data has been gathered to give a good picture of the effective flight range of Aedes albopictus. It is planned to shift the point of release in order to eliminate as much as possible local factors which might influence mosquito flights.

#### C. Preliminary Experiment with DDT

A preliminary experiment has been tried utilizing DDT as a dust for larval control. Test plots of one-tenth acre size have been laid out in a wooded area and receptacles containing larvae have been planted to observe the effectiveness of DDT dusting. Later it is expected that other tests will be run using DDT in solution and in emulsion. Both initial kill and residual kill are being checked.

#### D. Culturing Mosquitoes

In order to provide large numbers of larvae for the DDT experiments and for the flight range experiments, a system of culturing has been set up which is producing at the present time approximately 1,000 adult mosquitoes a week. Eggs are obtained from breeding cages of male and female Aedes albopictus which are maintained on sucrose, raisins and a growing plant. The females are provided with a blood meal at regular intervals. Egg-laying dishes are provided in the cages. The larvae are raised in flat dishes filled with water and with some organic debris. They are fed on polished rice and powdered dog biscuit. The total time of development is approximately 8 to 9 days with maximum food supplies at room temperatures of 80° to 84° F. Pupae are removed daily, counted and placed in the flight range cages and occasionally in the breeding cage to maintain the breeding stock. Larvae are removed from the larvae pans as needed for experimental purposes and to reduce crowding. Some difficulty and loss of larvae has been experienced due to the formation of a thick surface film of unknown origin and steps are being taken to prevent this formation. Particularly large and robust specimens are produced with water containing rice and a milky suspension of yeast.

Respectfully submitted,

/s/

Wesley E. Gilbertson

Wesley E. Gilbertson

P. A. Engineer (R)

i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
August, 1944

I. Monthly Summary

A. Dengue Fever Cases

Cases acquired within Territory--5 (civilian)  
Cases "off shipping"--19

B. Control Program--Territorywide (As covered in this report)

Number of Premises inspected	112,131
Number of premises breeding Aedes	990
Total personnel engaged in program	344

II. Epidemiology of Locally Acquired Cases

The five cases of dengue fever which occurred during the month of August were widely scattered throughout the City of Honolulu. It was not possible to connect any of them with previous cases, although three of them occurred in areas where dengue fever had been present some time ago--at Makaoe Lane in Waikiki, at Kahanu Street in Kalihikai and at the Kaluwahine Homesteads.

III. Control Activities in Honolulu

A. Special Activities Connected with Dengue Cases

On August 12 an area equivalent to about ten square blocks located in the vicinity of John Eha Road in the Waikiki district was sprayed with a power sprayer. This resulted from finding a dengue case with residence in that area and another case which was employed in the area. One block occupied by an industrial plant in the Kakaako district was sprayed.

In carrying out the above spraying activities, together with other individual premises sprayed, the following were covered:

Residences--123  
 Rooming houses--4  
 Apartments--17  
 Garages--45  
 Bomb Shelters--11

## B. Inspection and Indexes

The citywide Aedes breeding index in Honolulu continued to decrease during the first half of the month (0.7% to 0.6%). During the last half of August an increase to 0.8% occurred. Following is a summary of the month's activities:

No. of premises inspected	83,302
No. of premises breeding Aedes	574
Aedes breeding index on August 31	0.8%
No. of inspections per man-day	44

At the end of August six zones had indexes above 3% and one had an index above 5%.

## C. Special Crews

### 1. Trouble Shooting Crew

In addition to the spraying activities, the trouble shooting crew filled 2,827 tree holes with cement, of which 35 or 1.2% were breeding at the time; 447 rock holes were filled, of which 14 or 3.1% were breeding; 270 pipes were filled, of which none were breeding; and 210 bamboo stumps were filled, of which 4 or 1.9% were breeding.

### 2. Manhole and Catch Basin Larvicide Work

The motorcycle spray outfit was out of service most of August. However, together with the district control offices, the following work was done:

Storm drains checked	229
Storm drains larvicided	105
Storm drains breeding Aedes	7

### 3. Special larviciding activities included the treating of 9 ditches, 6 cesspools, 4 streams, 2 bomb shelters, 2 ground pools and one pillbox.

### 4. Roof Gutter Work

The roof gutters of 17 premises were inspected during the current period.



#### 5. Clean-up Activities

The clean-up crew collected and disposed of 70 truck loads of accumulated debris from 115 premises scattered throughout the city.

#### 6. Fish Stocking

The following places were stocked with mosquito minnows: 7 ponds, 2 tanks, 1 well and 1 bomb shelter.

#### 7. Inspection of USED baseyards and waterfront area

Fourteen USED baseyards were inspected during August. Three Aedes breeding places and two Culex breeding places were found. Forty-five piers and other installations along the Honolulu waterfront were also inspected, on which Aedes mosquitoes were found breeding in two places.

#### D. Personnel

	<u>Field</u>	<u>Total</u>
Army	85	85
Chamber of Commerce	6	9
U. S. Public Health Service	<u>31</u>	<u>43</u>
TOTAL	122	137

#### E. Public Education

Thirty-seven column inches of English and 12 column inches of foreign language news appeared in local newspapers during August.

#### IV. New Mosquito Control Regulation Adopted by Territory

On July 25, 1944, the Governor of Hawaii signed the new mosquito control regulation which had been presented to the Board of Health and approved. The new regulation, which is Section 73 of the Rules and Regulations of the Board of Health, clarifies and strengthens the legal aspects of mosquito control. The owner or tenant is responsible for maintaining the premises free of mosquito breeding under the regulation, which provides seven alternate methods of control depending upon the type of breeding place. Provision is made for inspections by the Board of Health for the purpose of enforcing the regulation.

## V. Release of the 715th Mosquito Control Detachment

The 715th Mosquito Control Detachment, which initially carried out mosquito control on the Island of Maui and later assigned to certain areas in rural Oahu, was released back to the Army on August 10, 1944 for transfer to forward areas.

## VI. Wahiawa Program

Personnel--4

The citywide Aedes breeding index at Wahiawa was 1.3% in mid-August and 0.5% at the end of the month. Analysis of the types of containers found breeding at Wahiawa indicates that ant cups and tires are the biggest problems. Following is a summary of the inspection activities for the month of August:

No. of premises inspected	2,888
No. of premises breeding Aedes	24
Aedes breeding index on August 31	0.5%

## VII. Kauai Program

Personnel--41

During the period July 15 through August 15 a total of 13,340 premises were inspected on the Island of Kauai. One hundred eighty-nine premises were found to be breeding Aedes mosquitoes. As of August 15, 21 cities and camps were under control on the island. One city--Hanalei--had an index above 3%. Following is a list of the Aedes breeding indexes as of August 15, 1944:

<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>	<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>
Eleele	---	Koloa	2.7
Hanalei	5.9	Koloa Mill	---
Hanamaula	---	Lihue	2.4
Hanapepe	---	Makaweli	---
Huleia Camp 3	1.1	Nawiliwili	.8
Kalaheo	.6	Port Allen	.8
Kapaa	.8	Puhi	---
Kapaia	---	Wahiawa	.5
Kealia	1.8	Camp 2	---
Kekaha	.2	Waimea	.3
Kilauea	1.1		



### VIII. Hawaii Program

Personnel--57

During the period July 16 through August 15 a total of 19,915 premise inspections were made on the Island of Hawaii. During this period Aedes mosquito breeding was found on 445 premises. Inspections were made in 23 cities and camps during the first half of August. Five places had indexes above 3% and one had an index above 5%

Following is a list of Aedes breeding indexes as of August 15, 1944:

<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>	<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>
Hakalau	4.1	Mt. View	4.4
Hawi	1.7	Naalehu	1.0
Hilo	1.6	Ninole	3.3
Honohina	2.2	Olaa	5.0
Honokaa	2.7	Ookala	1.8
Honomu	2.7	Paauhau	--
Honuapo	--	Pahala	1.2
Kailua	2.4	Pahoa	9.0
Kamuela	--	Papaaloa	1.5
Kealahakua	2.5	Papeikou	2.1
Kohala	2.1	Pepeekeo	2.5
Laupahoehoe	--		

From an islandwide standpoint, ant cups caused the most trouble. The most numerous breeder was the classification including barrels, tubs, tanks, jars and buckets. It is interesting to note that water-holding plants have not been a major source of mosquito breeding recently.

During the reported period the clean-up crew stocked 35 tanks with mosquito fish at Kealahakua and hauled 8 truckloads of containers from Hilo.

### IX. Rural Oahu Program

Personnel--105 (part time)

At the end of the first half of August the 719th Medical Sanitary Company received orders to take special training temporarily requiring about one-half of their time. For this reason it was not possible to cover rural Oahu communities as thoroughly as previously. The 715th Mosquito Control Detachment made repeat inspections in a number of communities which were covered for the

first time during the month of July. Since this detachment is being released, these communities will not receive further control.

In general, rural Oahu communities which have been under regular control have very low Aedes breeding indexes. None were above 1% during the month of August. In two communities, Haleiwa and Kahuku, no Aedes breeding was found.

Following are the Aedes breeding indexes for rural Oahu communities for the period ending as indicated:

Aedes Breed.

<u>Town</u>	<u>Index</u>	<u>Period</u>
Aiea	.3	8/15/44
Ewa	.2	8/31/44
Haleiwa	--	8/31/44
Kahuku	--	8/31/44
Kaneohe	1.0	8/15/44
Kuliouou	2.3	8/15/44
Kunia	1.6	8/15/44
Maile	10.8	8/15/44
Military Inst.	.2	8/15/44
Nanakuli	21.5	8/15/44
Niu	5.1	8/15/44
Moanalua	4.0	8/15/44
Pearl City	.1	8/31/44
Waiialua	.4	8/31/44
Waianae	4.4	8/15/44
Wailupe	5.7	8/15/44
Waipahu	.3	8/31/44

Respectfully submitted,

/s/ Wesley E. Gilbertson

Wesley E. Gilbertson  
P. A. Engineer (R)  
i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Monthly Narrative Report  
July, 1944

I. Monthly Summary

A. Dengue Fever Cases

Cases acquired within Territory--5 (civilian)  
Cases "off shipping"--4

B. Control Program--Territorywide (As covered in this report)

Number of premises inspected	111,544
Number of premises breeding Aedes	1,162
Total personnel engaged in program	307

II. Epidemiology of Locally Acquired Cases

The five cases of dengue fever which occurred during the month of July were all located in Honolulu but were scattered throughout the central and Kaimuki portions of the city. It was not possible to determine the likely source of infection of any of the cases. The only significant epidemiological finding was that two of the victims were employed at the Pearl Harbor Navy Yard, though in different parts of the yard.

III. Control Activities in Honolulu

A. Special Activities Connected with Dengue Cases

During the month of July the following premises were sprayed in the follow-up of dengue cases:

Residences--	150
Garages--	65
Barracks (Hickam Field)--	13
Apartments--	10
Stores--	6
Rooming houses and office buildings--	1 each
Restaurants--	2

The power spraying equipment was used at Hickam Field, at an Hawaiian Camp on Ilalo Street, and at a large restaurant.

## B. Inspection and Indexes

The citywide Aedes breeding index in Honolulu dropped from 1.1% at the end of June to 1.0% at the middle of July and 0.7% at the end of July. This is the lowest index experienced in Honolulu since the beginning of the program. Following is a summary of the month's activities:

No. of premises inspected	82,733
No. of premises breeding Aedes	727
Aedes breeding index on July 31	0.7%
No. of inspections per man-day	46

At the end of July two zones had indexes above 3% and one had an index above 5%.

## C. Special Crews

### 1. Trouble Shooting Crew

In addition to the spraying activities, the trouble shooting crew filled 2,004 tree holes with cement, of which 240 or 12% were breeding at the time. Also, 77 rock holes were filled of which 12 or 15% were breeding at the time.

### 2. Manhole and Catch Basin Larvicide Work

During the month the motorcycle spray outfit, together with supplemental aid from the district control offices, checked 514 storm drains and manholes and larvicided 184. Nineteen were found breeding mosquitoes.

### 3. Special larviciding activities included the treating of four cesspools, three ditches, two small streams, a swimming pool, an air raid shelter and a flooded basement of a building.

### 4. Roof Gutter Work

The roof gutters of 162 premises were inspected on which the following corrections were made: 38 gutters cleaned, 5 repaired, 4 removed and 3 perforated.

### 5. Clean-up Activities

During July the clean-up crew collected and disposed of 79 truck loads of accumulated debris from 140 premises scattered throughout the city.



#### 6. Fish Stocking

The following places were stocked with mosquito minnows:  
9 fish ponds, 3 streams, 1 ditch and 1 swamp.

#### 7. Inspection of USED baseyards

Twenty-three USED baseyards were inspected during July,  
of which 4 were found breeding Aedes mosquitoes.

#### D. Personnel

	<u>Field</u>	<u>Total</u>
Army	94	94
Chamber of Commerce	5	8
U. S. Public Health Service	<u>32</u>	<u>41</u>
TOTAL	131	143

#### E. Public Education

One hundred four column inches of English and 70 column inches  
of foreign language news appeared in the local newspapers during  
July.

#### F. Chamber of Commerce Budget Approved

The Public Health Committee of the Chamber of Commerce has  
approved a budget of \$3,724, plus \$500 balance, for dengue  
mosquito control for the six month's period, July through  
December, 1944.

### IV. Wahiawa Program

#### Personnel--4

In addition to the regular crew of four men at Wahiawa, a clean-up  
crew was assigned to the city for a temporary period. Large accumula-  
tions of tin cans, bottles and debris were cleared from twelve differ-  
ent locations.

Following is a summary of the inspection activities for the month of  
July:

No. of premises inspected	2,966
No. of premises breeding Aedes	30
Aedes breeding index on July 31	0.9%

## V. Kauai Program

Personnel--41

In general the Aedes breeding indexes on Kauai continued their downward trend during the last half of June and the first half of July. A total of 10,953 premise inspections were made from June 16 through July 15, of which 170 premises were found breeding Aedes. In a few cities--Hanalei, Kilauea and Nawiliwili--the Aedes breeding indexes were up. Following is a list of the Aedes breeding indexes as of July 15, 1944:

<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>	<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>
Eleele	1.1%	Koloa	1.6%
Hanalei	10.2	Koloa Mill	1.1
Hanamaulu	1.5	Lihue	1.5
Hanapepe	0.0	Makaweli	1.7
Huleia Camp 3	3.2	Nawiliwili	4.8
Kalaheo	5.0	Port Allen	0.0
Kapaa	.8	Puhi	.4
Kealia	.3	Wahiawa	1.6
Kekaha	.6	Camp 2	0.0
Kilauea	6.2	Waimea	.3
Kapaia	2.4		

For the period from the beginning of the work on March 27 through July 15, 1944, special work accomplished on Kauai including the periodic larviciding of 7 air raid shelters located in Kekaha and Hanapepe, the disposal of 7 truck loads of old tires and the larviciding of 135 additional tires, the disposal of 81 truck loads of miscellaneous receptacles and the filling of 3 ditches.

## VI. Hawaii Program

Personnel--57

During the period July 1 through July 15, 8,716 premise inspections were made on the Island of Hawaii of which 194 or 2.2% were found breeding Aedes. The islandwide index thus is lower than for the previous period. Other work included the stocking of 137 water tanks in Kealahou with mosquito fish. Following is a list of the indexes as of July 15, 1944:

<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>	<u>Town</u>	<u>Aedes Breed.</u> <u>Index</u>
Hakalau	1.5	Honokaa	.7
Hilo	1.9	Honouliuli	1.9
Honohina	1.2	Honouliuli	1.0



<u>Town</u>	<u>Aedes Breed.</u>	<u>Town</u>	<u>Aedes Breed.</u>
	<u>Index</u>		<u>Index</u>
Kailua	6.2	Ninole	13.7
Kamuela	3.8	Paauihau	0.0
Kealahakua	4.4	Pahala	.7
Kohala	.9	Pahoa	8.5
Laupahoehoe	2.9	Papaaloa	2.6
Mt. View	5.5	Papaikou	2.0
Naalehu	1.2	Pepeekeo	2.2

#### VII. Maui Program

The 715th Mosquito Control Detachment, upon receiving orders, left Maui and arrived on Oahu during the latter part of June. Several areas in rural Oahu are assigned to this unit for control.

As a means of maintaining surveillance on the mosquito breeding conditions on the Island of Maui, it is expected that all the more important cities and communities will be checked at intervals of about six weeks, using a small crew from the Honolulu program.

#### VIII. Rural Oahu Program

##### Personnel--62

The Aedes breeding index (combined) for the cities of rural Oahu which had been under regular control increased from .5% at the end of June to .6% at July 15 to 1.2% at the end of July. However, none of the cities had an index over 3.0%. Following is a summary the Aedes breeding indexes as of July 31:

<u>Town</u>	<u>Aedes Breed.</u>	<u>Town</u>	<u>Aedes Breed.</u>
	<u>Index</u>		<u>Index</u>
Aiea	1.0	Military Inst.	.2
Ewa	.4	Moanalua	4.6
Haleiwa	0.0	Niu	6.7
Kahuku	.2	Pearl City	.2
Kailua	.7	Waialua	1.2
Kaneohe	2.9	Wailupe	6.8
Kemoo	3.0	Waimanalo	.3
Kuliouou	8.3	Waipahu	1.3

#### IX. New Mosquito Control Laboratory

On July 1 the laboratory for the mosquito control program was moved from Bishop Museum to the Kalihi Hospital laboratory. At the beginning of the control program the Director of Bishop Museum generously provided laboratory space which was utilized until the end of June. By arrangement with the Director of District No. 10

the laboratory formerly utilized by the U. S. Public Health Service in connection with the leprosy hospital was made available. Adequate space is now provided for rearing and experimenting with mosquitoes and larvicides. Some of the equipment and supplies stored in the hospital are being utilized.

X. Accumulated Totals for Past Fiscal Year

From the beginning of the expanded program, September 15, 1943, to the end of the fiscal year, June 30, 1944, the following work was accomplished:

Total number of premise inspections . . . . .	995,223
Total number of premises breeding Aedes . . . . .	21,348
Total number of tree holes filled . . . . .	10,381
Total number of rock holes filled . . . . .	8,269
Total number of truck loads hauledd by clean-up crew	3,597
Total number of ponds stocked with mosquito fish	137

XI. Training of New Sanitary Company

A new colored sanitary company consisting of 114 men and 3 officers reported for training in Aedes mosquito control on July 12. After two days of classroom instruction followed by two days of field training in Honolulu, the group was assigned for further field training in rural Oahu. All phases of the control program were covered, including inspection, supervision, clean-up and statistical. The company was released on July 29, 1944.

Respectfully submitted,

/s/ Wesley E. Gilbertson  
P. A. Engineer (R)  
i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Twentieth Semi-Monthly Narrative Report  
Period Ending June 30, 1944

Note: Because of the greatly reduced incidence of dengue fever and the more routine nature of the control program, progress reports will hereafter be issued on a monthly basis.

I. Epidemiology

A. Number and Extent of Cases

One case of dengue fever, residing in the Waikiki district, was reported during the semi-monthly period ending June 30. This brings the total to date to 1,496 cases. Besides the single confirmed case of dengue, 5 suspected cases were reported during the period, all of which were diagnosed later as other diseases.

The total number of confirmed cases for the month of June is three. During July, 1943, the month in which the epidemic started, 8 cases were reported. During June, 1944, a period of three weeks elapsed without a single case being reported.

II. Special Work

A. Wholesale Spraying

Due to excessive mosquito breeding found in a twelve square block area in the Kapalama district between Vineyard and King Streets, the area was sprayed with a power sprayer on June 16. A total of 194 premises were covered.

Also to reduce the Aedes mosquito population, a smaller area comprised of 34 premises on Ohua Avenue in the Waikiki district was sprayed.

B. Trouble Shooting Crew

The trouble shooting crew sprayed 19 apartments, 11 garages, 8 dwellings and a business establishment in the follow up

of suspected and confirmed dengue cases during the period. Spraying operations proceed as soon as a suspected case is reported, rather than waiting until a positive diagnosis is made.

1. Manhole and Catch Basin Larvicide Work

Storm drains checked	111
" " sprayed	99
" " breeding	54

2. Tree and Rock Hole Filling Work

Tree holes filled--898  
Tree holes breeding at the time of filling--37  
Percent breeding--4.2%

Rock holes filled--251  
Rock holes breeding at the time of filling--31  
Percent breeding--16.3%

3. Fish Stocking and Miscellaneous

Six pools were stocked with fish, 35 upright pipes were filled and numerous Culex breeding areas were larvicided during the period.

C. Clean-up Crew

During the period the clean-up crew was reduced from approximately 30 men to 4 men, including the foreman. The number of clean-up referrals has gradually decreased during the past several weeks. It has been decided to utilize the dengue control clean-up crew only where no other means of removal of accumulations can be effectively utilized. Abatement orders will be served for removal of accumulations either through municipal sanitation services or otherwise. It is believed that this initial step in placing responsibility on the premise occupant or owner is justified.

During the past period a total of 88 truck loads of containers were disposed of from 119 different locations. The accumulations handled were as follows: 40 loads from Lanakila, 35 from Central and 13 from Kapahulu.

Permission has been granted by the City and County Board of Supervisors for the use of authorized dumps without payment of the usual dumping fee.



### III. Inspection and Indexes - Honolulu

#### Summary

No. of premises inspected	43,380
No. of premises breeding Aedes	466
Aedes breeding index	1.1%
No. of premises breeding Culex	139
Culex breeding index	0.3%
No. of inspections per man-day (7-hour day)	45.2

The present citywide index of 1.1% represents an increase of 0.1% in the previous semi-monthly period.

Following is a summary by districts of the zone indexes which were reduced, increased and unchanged:

<u>District</u>	<u>Zone Indexes</u> <u>Up</u>	<u>Zone Indexes</u> <u>Down</u>	<u>Zone Indexes</u> <u>Unchanged</u>
Central	10	14	4
Kapahulu	9	9	6
Lanakila	<u>15</u>	<u>6</u>	<u>4</u>
TOTAL	34	29	14

Six zones or 7% of the total had indexes above 3% and 3 zones or 4% of the total had indexes above 5%.

### IV. Personnel

#### A. Honolulu

	<u>Field</u>	<u>Total</u>
Army	90	90
Chamber of Commerce	4	6
U. S. Public Health Service	<u>35</u>	<u>47</u>
	129	143

The number of army personnel was reduced during the period from 148 to 90.

#### B. Rural Oahu, Kauai, Maui, Hawaii

##### Army:

Rural Oahu (including Wahiawa)--58  
Kauai--41  
Hawaii--57

## V. Public Education

### A. News Releases

Eleven column inches of English and 6 column inches of foreign language news releases appeared in the local newspapers during the current semi-monthly period.

## VI. Chamber of Commerce Budget for Dengue Mosquito Control

A budget was submitted to the Public Health Committee of the Chamber of Commerce of Honolulu covering proposed expenditures for the dengue mosquito control program for the period July 1 through December 31, 1944. A total of \$3,724 in new funds, plus approximately \$500 balance from the previous six-month period, was requested, giving a complete total of \$4,224. The budget for the previous six months was \$5,338.50.

## VII. Public Health Service Expenditures for the Past Quarter Year

<u>Month</u>	<u>Salaries</u>	<u>Supplies &amp; Equipment</u>	<u>Miscellaneous</u>
April	\$7416.28	\$1120.25	\$45.15
May	8245.42	667.25	19.30
June	<u>8314.49</u>	<u>378.52</u>	<u>38.25</u>
TOTAL	\$23,976.19	\$2,166.02	\$102.70

GRAND TOTAL--\$26,244.91

The grand total for the period January 1 through March 31, 1944 was \$27,051.53

## VIII. Maui Program

During the period June 1 through June 15, 7,007 premises were inspected. As of June 14 the mosquito control detachment on the Island of Maui discontinued operations in civilian areas by order of the Commanding General. The breakdown by cities for the worked period (June 1 through June 13) is as follows:

<u>City</u>	<u>No. Prem. Insp.</u>	<u>Prem. Breed. Aedes</u>	<u>Aedes Breed. Index</u>	<u>Prem. Breed. Culex</u>	<u>Culex Breed. Index</u>
Haiku	364	16	4.4	11	3.0
Kahului	721	2	.3	4	.6
Lahaina	1176	35	2.9	15	1.2
Makawao	277	11	4.0	12	4.3
Paia	1046	20	1.9	12	1.1
Puunene	1028	7	.7	9	.9
Spreckelsville	449	6	1.3	8	1.8
Waikapu	149	2	1.3	2	1.3
Wailuku	<u>1797</u>	<u>32</u>	<u>1.8</u>	<u>12</u>	<u>.7</u>
TOTAL	7007	131	1.8	85	1.2



The Aedes breeding index continued its downward trend on Maui from 2.5% to 1.8%. The greatest reduction was made in Haiku, while indexes in Makawao, Paia and Spreckelsville were somewhat higher than for the previous period.

#### IX. Wahiawa Program

##### Summary

No. of premises inspected	1,338
No. of premises breeding Aedes	7
Aedes breeding index	0.5%
No. of premises breeding Culex	25
Culex breeding index	1.8%
No. of inspections per man-day (7-hour day)	37.1

The citywide Aedes index increased 0.2% during the last half of June.

#### X. Kauai Program

A total of 6,858 premises was inspected during the period June 1 through June 15. The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Eleele	178	2	1.1	1	.5
Hanalei	71	3	4.2		
Hanamaulu	373	8	2.1	3	.8
Hanapepe	463	7	1.5	3	.6
Huleia Camp 3	191	6	3.1	1	.5
Kalaheo	307	12	3.9	8	2.6
Kapaa	483	9	1.8	4	.8
Kapaia	165	12	7.2	1	.6
Kealia	202	3	1.4		
Kekaha	444	6	1.3	4	.9
Kilauea	159	5	3.1	5	3.1
Koloa	645	16	2.4	11	1.7
Koloa Mill	185	3	1.6	1	.5
Lihue	769	20	2.6	4	.5
Makaweli	196	3	1.5	1	.5
Nawiliwili	231	14	6.0	2	.8
Port Allen	256	4	1.5		
Puhi	465	8	1.7	1	.2
Wahiawa	377	6	1.5	2	.5
Camp #2	118	6	1.1	1	.5
Waimea	580	8	1.4	5	.9
TOTAL	6858	161	2.3	57	0.8

The islandwide Aedes index for Kauai continued to decrease, this period being 0.3% lower than the previous period. Twelve communities had lower breeding indexes, 7 had higher indexes and one had the same index as the previous period.

#### XI. Rural Oahu Program

Only 28 premises located in Rural Oahu communities were found to have Aedes mosquito breeding in 5,475 inspections during the period June 16 through June 30. The combined index (0.5%) was 0.1% lower than for the previous period. The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Aiea	344	2	.5	2	.5
Ewa	860	2	.2	3	.3
Haleiwa	276	1	.3	2	.7
Kailua	843	4	.4	9	1.0
Kaneohe	934	13	1.3	12	1.2
Pearl City	528	1	.2	9	1.7
Waialua	539	2	.3		
Waimanalo	258	2	.7		
Waipahu	893	1	.1	12	1.3
TOTAL	5475	28	0.5	49	0.8

#### XII. Hawaii Program

Of 9,766 premise inspections, Aedes breeding was found on 247 premises during the period June 16 through June 30. The islandwide index increased slightly--2.3% to 2.5%. In Hilo, the index decreased from 2.4% to 2.3%. The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Hakalau	226	7	3.0	2	.8
Hawi	284	14	4.9	2	.7
Hilo	5042	121	2.3	48	.9
Honohina	84	9	10.7	0	.0
Honokaa	400	2	.5	2	.5
Honolulu	251	3	1.1	0	.0
Honuaipo	50	0	.0	0	.0
Kailua	41	8	19.5	0	.0
Kealahou	231	11	4.7	3	1.2
Kohala	316	0	.0	0	.0
Laupahoehoe	87	1	1.1	1	1.1



<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Mt. View	290	5	1.7	5	1.7
Naalehu	185	2	1.0	0	.0
Olaa	495	14	2.8	4	.8
Ookala	213	4	1.8	0	.0
Paauhau	180	0	.0	0	.0
Pahala	387	3	.7	3	.7
Pahoa	200	7	3.5	8	4.0
Papaaloa	170	8	4.7	3	1.8
Papaikou	288	8	2.7	1	.3
Pepeskeo	264	7	2.6	1	.3
Wailea	81	13	16.0	1	1.2
TOTAL	9766	247	2.5	84	.8

Other work included: the stocking of 135 water tanks in Kealahakua with mosquito fish; and disposing of 8 1/2 truckloads of containers collected in Hilo.

XIII. Summary: Territory of Hawaii

No. of premises inspected	73,824
No. of premises breeding Aedes	1,040
Total personnel engaged in program	342

Respectfully submitted,

/s/ Wesley E. Gilbertson  
Wesley E. Gilbertson  
P. A. Engineer (R)  
i/c Dengue Mosquito Control

Note: P. A. Sanitary Engineer (R) Bernard B. Berger who very successfully conducted the territorywide dengue mosquito control program during my absence has been assigned by the Board of Health as Sanitary Engineer for the Island of Hawaii.





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Nineteenth Semi-Monthly Narrative Report  
Period Ending June 15, 1944

I. Epidemiology

A. Number and Extent of Cases

Two cases of dengue fever were reported during the semi-monthly period ending June 15. This brings the total to date to 1,495 cases. These two cases, a decrease of one case from the previous semi-monthly period, represent the lowest semi-monthly incidence of the disease since the beginning of the control program.

The two cases were reported on the first day of the month. We have therefore not had a case of dengue reported for a period of two weeks. This is the longest period with no case of dengue fever reported since the beginning of the epidemic in July, 1943.

II. Special Work

A. Wholesale Spraying

One residential area including 107 individual premises, a Coast Guard station and a school were power sprayed during the current period.

B. Trouble Shooting Crew

The trouble shooting crew sprayed 11 dwellings during this period.

1. Manhole and Catch Basin Larvicide Work

Storm drains checked	168
" " sprayed	22
" " breeding	28

2. Tree and Rock Hole Filling Work

Tree holes filled--1,812  
Tree holes breeding at the time of filling--21  
Per cent breeding--1.2%

Rock holes filled--388

Rock holes breeding at the time of filling--21

Per cent breeding--6.4%

### 3. Fish Stocking

Three fish ponds, 27 storm drains and a culvert were stocked with fish during the current period. In the case of the storm drains, grit and street debris deposited in the catch basins partly plugged the drains, preventing flow at low water depth. Several instances of *Aedes* and *Culex* breeding were observed in the water in the drains. Oiling was not too effective due to slight intermittent rainfall and resulting loss of larvicide. Resort was made to the use of mosquito destroying fish as a simple and effective means of control until action could be taken by the public authorities. A similar condition existed at the culvert.

4. Miscellaneous control activities included the filling of 193 vertical fence pipes, and oiling of two cess-pools and one stream.

5. The low reported dengue incidence will permit the use of the power spraying equipment in areas where *Aedes* breeding is found to be high, although the disease may be absent. A spot map showing the locations of active breeders found is being maintained. When centers of breeding are determined, a massive spraying job will be performed to coincide with an intensive inspection of the area.

### C. Roof Gutter Crew

The roof gutter crew inspected 60 premises, of which 50 were found to have unsatisfactory gutters. Thirty-nine roof gutters were cleaned, 5 perforated, 4 removed and 2 repaired.

### D. Clean-up Crew

With an average working force of 32 men utilizing 3 one and one-half ton trucks and 1 one-half ton truck, the clean-up crew collected and disposed of 100 truckloads of miscellaneous bottles and tin cans.

Due to the public health necessity for rigid control of garbage and rubbish disposal sites, the Board of Supervisors of the City and County of Honolulu has authorized the use of only two dumps in the city. The two sites are city-owned and supervised. A fee of 50 cents per cubic yard of



waste is charged. Special action on the part of the Board of Supervisors is required in order that the Honolulu Dengue Mosquito Control program may be permitted the use of these authorized dumps without payment of the charge. The necessary steps for the approval of our use of the authorized dumps have been taken. Until approval is obtained, the operations of our clean-up crews will be seriously curtailed.

- E. A study of the statistical reports indicates that the recent Bottle Removal Drive sponsored by the Honolulu Junior Chamber of Commerce resulted in the elimination of approximately 11,000 bottles in Honolulu which were classified as potential mosquito breeders.

### III. Inspection and Indexes - Honolulu

#### Summary

No. of premises inspected	41,127
No. of premises breeding Aedes	418
Aedes breeding index	1.0%
No. of premises breeding Culex	128
Culex breeding index	0.3%
No. of inspections per man-day (7-hour day)	45.2

The present citywide index of 1.0% represents no change from the index of the previous semi-monthly period.

Several factors for the interruption in the definite downward trend of Aedes breeding may be mentioned. As Aedes breeding reaches the relatively low levels indicated by the recent indexes, it becomes increasingly difficult to produce further reductions. A second factor may be the rainfall occurring during the latter part of the period. A third factor is the recent intensified inspection of vacant premises. Spot checks by supervisory personnel had indicated that vacant premises in residential areas were not being covered thoroughly by the inspectors. It was also found that many vacant premises were being used as disposal sites by neighboring residents. In several cases such unwholesome practices were referred to the police authorities.

Following is a summary by districts of the zone indexes which were reduced, increased and unchanged:

<u>District</u>	<u>Zone Indexes</u> <u>Up</u>	<u>Zone Indexes</u> <u>Down</u>	<u>Zone Indexes</u> <u>Unchanged</u>
Central	10	14	4
Kapahulu	7	15	2
Lanakila	9	13	3
TOTAL	26	42	9

Eight zones or 10% of the total had indexes above 3% and 3 zones or 4% of the total had indexes above 5%.

#### IV. Personnel

##### A. Honolulu

	<u>Field</u>	<u>Total</u>
Army	148*	148*
Chamber of Commerce	2	4
U. S. Public Health Service	<u>35</u>	<u>47</u>
TOTAL	185	199

##### B. Rural Oahu, Kauai, Maui, Hawaii

###### Army:

Rural Oahu (including Wahiawa)--58  
Kauai--41  
Maui--43  
Hawaii--57

#### V. Public Education

##### A. News Releases

Sixteen column inches of English and 8 column inches of foreign language news appeared in the local newspapers during the semi-monthly period.

##### B. Radio

The previous schedule of spot announcements (1-a-day) was continued.

##### C. Public Talks

Two public talks were given by officers on the staff of the Honolulu Dengue Control during this period. These talks included one given before the Custodians Association of Oahu and a talk entitled "Progress on Dengue Control in Honolulu" given before the Engineering Association of Hawaii.

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\*Includes 91 men on detached service and 57 men from a Medical Sanitary Company. Near the end of the period, the latter were recalled to their organization for a different assignment. Assurance has been given that replacements will be assigned to the Honolulu Dengue Control program.



VI. Excerpts of Talk Given to Engineering Association of Hawaii

"The prospects at the present time of eliminating dengue fever from the civilian population in the Territory are fair. The incidence of the disease has shown a definite response to the control techniques applied. The highest weekly incidence of dengue amongst the civilian population in Honolulu was 159 cases. This occurred shortly after the expanded control program was initiated. At the present time the weekly incidence is between one and two cases. As a matter of fact, we have had no case of dengue reported to us for approximately two weeks.

"This favorable picture must necessarily be qualified. We have reason to believe that dengue among the civilian population still occurs but remains unreported as no physician may be called. We have a large susceptible population and we know, of course, that *Aedes* mosquitoes are prevalent. We still have with us, therefore, the three elements necessary for dengue transmittal in epidemic form.

"With our present control methods we can expect to terminate dengue among the civilian population in the Territory only by the elimination of the virus causing the disease. That is why we attach such considerable importance to reporting and epidemiological work, isolation of victims and the destruction of *Aedes* mosquitoes at locations designated by the epidemiological survey.

"We do not believe it feasible to destroy all *Aedes* mosquitoes in the Territory. We find that our inspection-correction-education program is extremely effective against *Aedes aegypti* but not quite as effective against *Aedes albopictus*. It appears that *Aedes aegypti* exhibits a definite preference for breeding in those containers usually found in the immediate vicinity of habitations. *Aedes albopictus*, however, would apparently just as soon breed in tree holes, rock holes and other natural containers as in tin cans and bottles. Such natural containers are frequently difficult to uncover, especially in the heavily wooded areas at the heads of the valleys extending into the city of Honolulu. The time, effort and manpower required to find and eliminate the breeding places in such locations make this activity unfeasible and unwarranted at the present time. At the start of this control program it was estimated that *Aedes albopictus* and *Aedes aegypti* were present in a ratio of 4 to 1. The present ratio is at least 15 to 1. These ratios clearly indicate the greater effectiveness of our inspection program in the elimination of *Aedes aegypti*.

"The question will undoubtedly be asked whether or not the control program should be terminated when we are certain that dengue fever has been definitely eliminated from the civilian population.

It is our opinion that the control program should not be terminated at least as long as the war effort in the Territory is essential. We know definitely that we will have two of the three elements necessary for the spread of the disease. These two elements are the transmitting mosquitoes, Aedes albopictus (assuming we destroy all Aedes aegypti mosquitoes) and a large susceptible population. We are also aware that the danger of re-introducing dengue fever to the Territory is ever-present. The military authorities are taking effective measures to protect military personnel and the civilian population from "off shipping" cases. There is always a chance, however, that a case will escape observation and that protective measures adopted will not be applied. If this should occur, a new dengue epidemic might actually be in the offing."

## VII. Maui Program

During the period May 16 through May 31, 8,037 premises were inspected. The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Haiku	479	41	8.5	20	4.1
Kahului	454	6	1.3	5	1.1
Lahaina	2022	67	3.3	31	1.5
Makawao	506	3	.6	9	1.8
Paia	1069	18	1.7	11	1.0
Puunene	999	14	1.4	20	2.0
Spreckelsville	450	4	.9	5	1.1
Waikapu	132	2	1.5	4	3.0
Wailuku	1926	45	2.3	19	1.0
TOTAL	8037	200	2.5	124	1.4

The Aedes breeding index for the latter semi-monthly period of May was 2.5%. This represents a decrease of 0.4% from the previous period. The Aedes breeding index was lower in all communities on Maui with the exception of Haiku, Kahului and Waikapu.

One community of the nine covered during this period had an Aedes breeding index above 5% and two had Aedes breeding indexes above 3%.

This office was informed that during the early part of June the activities of the Mosquito Control Detachment on the Island of Maui were temporarily restricted to military areas. The continuity of the program has therefore been broken.



# VIII. Wahiawa Program

## Summary

No. of premises inspected	2,115
No. of premises breeding Aedes	7
Aedes breeding index	0.3%
No. of premises breeding Culex	28
Culex breeding index	1.3%
No. of inspections per man-day (7-hour day)	51.6

The citywide Aedes breeding index, 0.3%, for the first semi-monthly period in June represents no change from the index for the previous semi-monthly period. Aedes breeding was found on only 7 premises of 2,115 premises inspected. The control in Wahiawa has reached the point where significant decreases in the Aedes breeding may no longer be expected.

# IX. Rural Oahu Program

Aedes breeding was found on 32 premises of 5,530 inspected during the first semi-monthly period of June. The Aedes breeding index in rural Oahu was therefore 0.6%, the same as that for the previous period.

The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Aiea	562	8	1.4	1	.1
Ewa	841	0	.0	2	.2
Haleiwa	279	1	.3	0	.0
Kahuku	417	0	.0	1	.2
Kailua	811	5	.6	3	.3
Kaneohe	1004	15	1.4	8	.7
Pearl City	461	1	.2	0	.0
Waialua	527	0	.0	1	.1
Waimanalo	258	1	.3	2	.7
Waipahu	370	1	.3	5	1.4
TOTAL	5530	32	0.6	23	0.4

Of the 10 communities included in the program, 7 had lower Aedes breeding indexes during the current period than in the latter part of May, and 3 had higher indexes.

A total of 51 containers was found in which active Aedes breeding was taking place. Twenty-six of these containers were located inside residences.

## X. Kauai Program

A total of 6,615 premises was inspected during the period May 16 through May 31, 1944, the last period for which statistical reports have been submitted. The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Eleele	89	0	.0	0	.0
Hanalei	134	6	4.4	4	2.9
Hanamaulu	359	12	3.3	2	.5
Hanapepe	234	3	1.2	2	.8
Huleia Camp 3	65	3	4.6	2	3.0
Kalaheo	133	4.	3.0	0	.0
Kapaa	858	29	3.3	12	1.3
Kapaia	154	14	9.0	5	3.2
Kealia	415	3	.7	3	.7
Kekaha	863	22	2.5	3	.3
Kilauea	352	12	3.4	6	1.7
Koloa	331	10	3.0	5	1.5
Koloa Mill	94	5	5.3	0	.0
Lihue	821	20	2.4	3	.3
Makaweli	373	7	2.4	3	.3
Nawiliwili	66	3	4.5	2	3.0
Port Allen	120	0	.0	0	.0
Puhi	233	3	1.2	1	.4
Wahiawa	189	4	2.1	0	.0
Camp #2	58	2	3.4	0	.0
Waimea	674	10	1.4	8	1.1
TOTAL	6615	172	2.6	58	0.8

The Aedes breeding index for the Island of Kauai during the latter half of May was 2.6%, a decrease of 0.4% from the Aedes breeding index for the previous period.

Twelve communities had lower breeding indexes and seven communities had higher breeding indexes during the period May 16 through May 31 than in the previous period. In two communities the Aedes breeding indexes did not change.

The control program on the Island of Kauai appears to be operating smoothly. While there are no spectacular drops in the Aedes breeding index, the decrease in breeding has been consistent.

## XI. Hawaii Program

During the first half of June 10,120 premises were inspected. Aedes breeding was found on 236 premises. The Aedes breeding index, 2.3%, represents a decrease of 1.1% from the index for the previous period.



The summary by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Hakalau	222	1	.4	0	.0
Hawi	277	2	.7	2	.7
Hilo	5290	129	2.4	49	.9
Honokaa	401	2	.4	3	.7
Honoumu	249	6	2.4	4	1.6
Honuapo	49	0	.0	0	.0
Kamuela	77	0	.0	2	2.5
Kohala	315	1	.3	2	.6
Laupahoehoe	87	1	1.1	0	.0
Mt. View	292	13	4.4	7	2.3
Naalehu	188	5	2.6	2	1.0
Olaa	979	42	4.2	12	1.2
Ookala	209	5	2.3	2	.9
Paauehu	200	3	1.5	0	.0
Pahala	373	8	2.1	7	1.8
Pahoa	189	12	6.3	8	4.2
Papaaloa	188	1	.5	1	.5
Papaikou	290	2	.7	0	.0
Pepeekeo	245	3	1.2	1	.4
TOTAL	10,120	236	2.3	102	1.0

Of the 21 communities inspected during the latter half of May, 19 were re-inspected during the first part of June. The Aedes breeding index was lower in fourteen communities and higher in five communities during the first half of June than in the previous semi-monthly period.

The Aedes breeding index for Hilo was lowered from 3.0% in the latter part of May to 2.4% in the first part of June.

A study of the types of containers breeding Aedes indicates that barrels and other large containers in Hilo, Olaa and Mt. View constitute approximately one-third of all the active breeders found on the island.

The length of the inspection cycle for the crews operating on the Island of Hawaii appears to be satisfactory. With the exception of a few minor communities, the island was covered within a fourteen day period.

Two clean-up crews operating in Hilo collected and disposed of twenty-six 1-1/2 ton truck loads of miscellaneous tin cans and bottles during the first semi-monthly period in June.

Sixty-one water storage tanks in Pahoa, 59 in Kailua and 52 in Kealahou were stocked with mosquito fish during the first half of June. The fish stocking program remains an important control measure in many areas on the Island of Hawaii.

During the latter half of May, 46 samples were collected from active *Aedes* breeders in six communities on the Island of Hawaii. On the emergence of the adult mosquito, 41 samples were identified as *Aedes albopictus* and 5 as *Aedes aegypti*. The three cities where *Aedes aegypti* were found were Hilo, Mt. View and Olaa.

XIII. Summary: Territory of Hawaii

No. of premises inspected	73,544
No. of premises breeding <i>Aedes</i>	1,065
Total personnel engaged in program	398

During the current semi-monthly period officers of the dengue mosquito control program made visits to Hawaii and Maui.

Respectfully submitted,

/s/Bernard B. Berger  
Bernard B. Berger  
P. A. Sanitary Engineer (R)  
i/tc Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Eighteenth Semi-Monthly Narrative Report  
Period Ending May 31, 1944

I. Epidemiology

A. Number and Extent of Cases

Three cases of dengue fever were reported during the semi-monthly period ending May 31. This brings the total to date to 1,493 cases. These three cases, a decrease of 9 cases from the previous semi-monthly period, represent the lowest semi-monthly incidence of dengue since the beginning of the control program.

None of the three cases occurred in an area previously defined as a focus of infection. The two incipient foci in Kapalama and Kalihi-uka described in the preceeding report were apparently eliminated without further transmission of the disease.

In addition to the three cases occurring during this period, seven suspected cases were reported but not confirmed.

II. Special Work

A. Wholesale Spraying

One residential area, a hotel and vicinity, and a church and vicinity were power-sprayed during the current period. The residential area sprayed included 130 separate premises in the Makiki section which had been visited by an inspector on this program who was a suspected case.

B. Trouble Shooting Crew

The trouble shooting crew sprayed a total of 187 residences and 11 business establishments.

1. Manhole and Catch Basin Larvicide Work

Storm drains checked	333
" " sprayed	81
" " breeding	75

## 2. Tree and Rock Hole Filling Work

Tree holes filled--2,001

Tree holes breeding at the time of filling--24

Per cent breeding--1.2%

Rock holes filled--400

Rock holes breeding at the time of filling--2

Per cent breeding--0.5%

## 3. Fish Stocking

Sixteen privately owned ponds and nine cisterns were stocked with fish during the current period.

## 4. Miscellaneous control activities included the filling of 312 vertical fence pipes and oiling of numerous ground pools and cesspools.

## C. Roof Gutter Crew

The roof gutter crew inspected 54 premises of which 42 were found to have unsatisfactory gutters. Thirty-four roof gutters were cleaned, 4 perforated, 3 repaired and 1 removed.

## D. Clean-up Crew

With an average working force of 33 men utilizing 5 trucks, the clean-up crew collected and disposed of 240 one and one-half ton loads of miscellaneous bottles and tin cans.

## III. Inspection and Indexes - Honolulu

### Summary

No. of premises inspected	46,316
No. of premises breeding Aedes	502
Aedes breeding index	1.0%
No. of premises breeding Culex	122
Culex breeding index	0.2%
No. of inspections per man-day (7-hour day)	45

The present citywide index of 1.0% represents a decrease of 0.3% from the semi-monthly period ending May 15.



Following is a summary by districts of the zone indexes which were reduced, increased and unchanged:

<u>District</u>	<u>Zone Indexes</u> <u>Up</u>	<u>Zone Indexes</u> <u>Down</u>	<u>Zone Indexes</u> <u>Unchanged</u>
Central	7	18	3
Kapahulu	9	12	3
Lanakila	<u>5</u>	<u>14</u>	<u>6</u>
TOTAL	21	44	12

Seven zones or 9% of the total had indexes above 3% and 2 zones or 2.6% of the total had indexes above 5%.

#### IV. Personnel

<u>A. Honolulu</u>	<u>Field</u>	<u>Total</u>
Army	148	148
Chamber of Commerce	2	4
U. S. Public Health Service	<u>35</u>	<u>47</u>
TOTAL	185	199

#### B. Rural Oahu, Kauai, Maui, Hawaii

Army:

Rural Oahu (including Wahiawa)--58  
 Kauai--41  
 Maui--43  
 Hawaii--57

#### V. Public Education

##### A. News Releases

One hundred sixty column inches of English and 80 column inches of foreign language news appeared in the local newspapers during the semi-monthly period.

##### B. Radio

The previous schedule of spot announcements (1-a-day) was continued.

#### VI. Gratuities for Military Personnel on Detached Service Assigned to Honolulu Dengue Mosquito Control

The Honolulu Chamber of Commerce in cooperation with the Territorial Board of Health and the U. S. Public Health Service and with the approval of the military authorities has granted monthly

gratuities to all men on detached service with the Honolulu dengue mosquito control program. The first gratuities were disbursed for the month of May. Among the justifications for this program are the following: (1) Proper adjustments in army ranks corresponding to assigned duties and responsibilities cannot be made for army personnel on detached service with the Honolulu control program. (2) Assigned personnel have demonstrated interest in the work and there has been a definite increase in proficiency. (3) Service personnel assigned to this program are required to have a neat appearance, necessitating higher laundry bills than normal. (4) The gratuities will be appreciated by the men as a recognition of the important service performed.

## VII. Maui Program

During the period May 1 through May 15, 7,944 premises were inspected. The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Haiku	323	13	4.0	8	2.4
Kahului	425	1	.2	2	.4
Lahaina	980	65	6.6	29	2.9
Makawao	135	13	9.6	3	2.2
Paia	1737	32	1.8	13	.7
Puunene	1000	26	1.6	16	1.6
Spreckelsville	395	6	1.5	5	1.2
Waikapu	140	1	.7	2	1.4
Wailuku	<u>2809</u>	<u>80</u>	<u>2.8</u>	<u>37</u>	<u>1.3</u>
TOTAL	7944	237	2.9	115	1.4

The Aedes breeding index for the Island of Maui during the first semi-monthly period in May was 2.9%. This represents a decrease of 2.3% from the previous period. The Aedes breeding index was lowered in all communities on Maui with the exception of Puunene.

Two communities of the 9 covered during this period had Aedes breeding indexes above 5%. Three had breeding indexes above 3%.

A total of 37 truck-loads of miscellaneous tin cans and bottles were collected and removed for permanent disposal. In addition, 37 truck-loads of worthless tires were collected from a garage in Wailuku and removed to a dump for disposal.

Some difficulty is being experienced in the efficient operation of the clean-up crews due to the few available dumping grounds. The military authorities on this island are experiencing similar difficulties and are taking steps to obtain new dumping grounds.



These will be made available to the clean-up crews on the local mosquito control program.

The inspection crews are completing the inspectional cycles within the desired elapsed time. One crew is at present operating on a 10-day cycle, the other on a 14-day cycle. Minor adjustments will be made in order that the inspection cycle of each of the two crews may be equal.

An officer on the Honolulu staff visited Maui during this period and investigated the proficiency of the men engaged in inspection. Emphasis was placed on the need for an intensified inspection, especially in regard to the uncovering of concealed breeders.

#### VIII. Kauai Program

A total of 4,642 premises were inspected during the period May 1 through May 15, 1944. The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Eleele	89	1	1.1	1	1.1
Hanalei	65	3	4.6		
Hanamaulu	182	6	3.2	4	2.1
Hanapepe	209	2	.9	1	.4
Huleia Camp 3	58	4	6.8	1	1.7
Kalaheo	126	2	1.5	2	1.5
Kapaa	406	18	4.4	4	.9
Kapaia	73	4	5.4	2	2.7
Kealia	192	5	2.6	2	1.0
Kekaha	435	13	2.9	2	.4
Kilauea	175	11	6.2		
Koloa	316	18	5.6	9	2.8
Koloa Mill	92	3	3.2	1	1.0
Lihue	681	18	2.6	4	.5
Makaweli	186	12	6.4	1	.5
Nawiliwili	136	4	2.9	2	1.4
Port Allen	127	2	1.5		
Puhi	476	6	1.2	1	.2
Wahiawa	184	4	2.1		
Camp #2	60				
Waimea	374	6	1.6	4	1.0
	4642	142	3.0	41	0.8

The Aedes breeding index for the Island of Kauai during this period was 3.0%. This represents a decrease of 1.2% from the Aedes breeding index for the previous period.

Twelve communities had lower breeding indexes and 9 communities had higher breeding indexes during the period May 1 through May 15 than in the previous period.

The number of days of elapsed time to complete an inspectional cycle was 14 during the current period.

#### IX. Wahiawa Program

##### Summary

No. of premises inspected	2,298
No. of premises breeding Aedes	9
Aedes breeding index	0.3%
No. of premises breeding Culex	13
Culex breeding index	0.5%
No. of inspections per man-day (7-hour day)	45.9

The citywide Aedes breeding index, 0.3%, for the latter semi-monthly period in May represents a decrease of 0.1% from the index for the semi-monthly period ending May 15. Only nine containers on nine premises were found to be breeding Aedes at the 2,298 premises inspected. The successful operation of the inspection program in Wahiawa is due in large measure to the efforts of the Wahiawa Community Association in enlisting the cooperation of the local population.

#### X. Rural Oahu Program

Seven thousand four hundred sixty-three premises were inspected during the period May 16 through 31, 1944.

The statistical summary by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Aiea	1013	5	.4	3	.2
Ewa	855	5	.5	6	.7
Haleiwa	303				
Kahuku	413	1	.2		
Kailua	832	7	.8	2	.2
Kaneohe	1023	18	1.7	6	.5
Pearl City	493	2	.4	4	.8
Waialua	665	1	.1		
Waimanalo	520	2	.4	1	.2
Waipahu	1346	4	.2	9	.6
TOTAL	7463	45	0.6	31	0.4

The overall Aedes breeding index in rural Oahu was 0.6% during the latter semi-monthly period in May. This represents a decrease of 0.2% from the Aedes breeding index for the first part of May.



Of the ten communities included in the program, seven had lower Aedes breeding indexes in the latter part of May than in the first part of May, two had higher indexes and one remained stationary. A total of 63 active Aedes breeders was found on 45 of the 7,463 premises inspected.

#### XI. Hawaii Program

Nine thousand nine hundred twenty-six premises were inspected during the latter half of May. Of these, 338 premises were found to be breeding Aedes, giving an index of 3.4%. The summary by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Hakalau	222	11	4.9	4	1.8
Hawi	280	2	.3	2	.3
Hilo	5086	156	3.0	52	1.0
Honokaa	382	3	.7	6	1.5
Honomu	253	8	3.1	6	2.3
Honuapo	48	1	2.0		
Kailua	79	4	5.0	2	2.5
Kamuela	69	1	1.4	3	4.3
Kealahkekua	462	34	7.3	8	1.7
Kohala	313	8	2.5	1	.3
Laupahoehoe	87	4	4.6	1	1.1
Mt. View	287	23	8.0	13	4.5
Naalehu	186	3	1.6	2	1.0
Olaa	486	37	7.6	7	1.4
Ookala	213	3	1.4		
Paaauhau	205			2	.9
Pahala	355	5	1.4	5	1.4
Pahoa	185	17	9.1	5	2.7
Papaaloa	189	6	3.1	1	.5
Papaikou	294	8	2.7	14	4.7
Pepeekeo	245	4	1.6		
	9926	338	3.4	134	1.3

The present islandwide breeding index is 0.9% greater than the index for the previous period. The Aedes breeding index for the city of Hilo increased from 1.9% for the first half of May to 3.4% for the latter part of the month. The rise in the islandwide Aedes breeding index is due in large measure to the greater number of premises in Hilo found breeding. A contributing factor was the inclusion of vacant premises in Hilo in the inspectional program. An officer on the staff of the Honolulu Dengue Mosquito Control had visited Hawaii during the period and observed that vacant premises were not being inspected. The need for the complete elimination of breeders on such premises was emphasized, especially in view of the undesirable

usage of these locations as private dumps. Increased rainfall and more effective inspection were also important factors contributing to the increase in Aedes breeding.

Of the 21 communities covered during the first part of May, 20 were reinspected during the latter half of the month. Of these 20 communities the Aedes breeding index was higher in 11 communities during the latter half of the month than in the first part of May.

Two clean-up crews operating in Hilo collected and permanently disposed of 19 truck-loads of tin cans and bottles during the latter semi-monthly period in May.

One hundred ninety-two water storage tanks in Mt. View and 178 in Pahoa were stocked with mosquito fish during the last half of May. The fish stocking program is an important control measure in certain areas on the Island of Hawaii. In several communities almost every residence has a rain water storage barrel, usually without adequate cover and not infrequently containing mosquito larvae.

XII. Summary: Territory of Hawaii

No. of premises inspected	78,589
No. of premises breeding Aedes	1,273
Total personnel engaged in program	398

During the current semi-monthly period officers of the dengue mosquito control program made visits to Hawaii and Maui to check on the progress of the local programs and to advise on more efficient operation.

Respectfully submitted,

/s/ Bernard B. Berger  
Bernard B. Berger  
P. A. Sanitary Engineer (R)  
i/tc Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Seventeenth Semi-Monthly Narrative Report  
Period Ending May 15, 1944

I. Epidemiology

A. Number and Extent of Cases

Twelve cases of dengue fever were reported during the semi-monthly period ending May 15. This brings the total to date to 1,490 cases. These 12 cases represent an increase of 7 cases from the previous semi-monthly period.

Three of the cases occurred in the Kalihi-uka area defined earlier as a focus of infection. The three cases occurred in two adjacent houses. The entire section was resprayed to eliminate the adult mosquitoes.

The last case in the Kalihi-uka area had occurred in the first week of April. It appeared probable that intermediate unreported cases had been present. In an effort to determine the existence of unreported cases, the Public Health nurse assigned to the Territorial Board of Health was requested to make a premise-to-premise investigation. No cases, however, were uncovered in this canvassing.

A new focus of infection was apparent in the Kapalama section where three cases occurred in Kaauwai Place. Massive spraying was resorted to in this section to destroy the adult mosquitoes.

Several cases occurred in Nuuanu. The locations of these cases were not far from the Iolani School section where massive spraying had been applied several months ago. This general area will be closely observed in order that proper remedial action might be taken immediately upon the determination of a focus of infection.

The remaining cases were scattered throughout the city.

II. Special Work

A. Wholesale Spraying

Two residential areas were sprayed during the current period. These areas were in the Kalihi-uka and Kapalama sections. A total of 103 premises was covered.

B. Trouble Shooting Crew

The trouble shooting crew sprayed 122 residences, 3 tenements, 9 business establishments, 2 pillboxes and a cathedral.

1. Manhole and Catch Basin Larvicide Work

Storm drains checked	195
" " sprayed	52
" " breeding	24

2. Tree and Rock Hole Filling Work

Tree holes filled--1,335  
Tree holes breeding at the time of filling--10  
Per cent breeding--0.7%

Rock holes filled--2,495  
Rock holes breeding at the time of filling--5  
Per cent breeding--0.2%

3. Fish Stocking

Eight privately owned ponds were stocked with fish during the current period.

4. Miscellaneous control activities included a stream and numerous ground pools at an evacuation camp oiled.

C. Roof Gutter Crew

During the current period the roof gutter crew inspected 255 premises of which 160 were found to have unsatisfactory gutters. One hundred thirty-one roof gutters were cleaned, 7 perforated, 7 repaired, 4 removed and orders issued to 11 householders to make permanent corrections.

D. Clean-Up Crew

With an average working force of 30 men utilizing 5 trucks, the clean-up crew collected and disposed of 144 one and one-half ton loads of miscellaneous bottles and tin cans.

III. Bottle Collection Drive

A Bottle Collection Drive sponsored by the Honolulu Junior Chamber of Commerce and endorsed by the Soft Drink Bottlers' Asso-



ciation, several breweries and liquor manufacturers and two dairies commenced on May 15. For a period of one week all grade school children on the Island of Oahu will collect bottles and bring them to a central disposal center where remuneration will be made by firms owning these containers.

In previous drives the collection was limited to soft drink bottles. At the instigation of the dengue mosquito control program, the present drive was expanded to include glass containers of every variety. The unclaimed bottles will be moved to the municipal dump by dengue mosquito control clean-up crews. Further assistance by means of publicity is being provided.

The bottle collection drive will undoubtedly result in the permanent elimination of large numbers of actual and potential Aedes breeders. It is estimated that a million containers will be moved. The enthusiastic participation of the school children was apparent on the first day of the drive.

An appraisal of the effectiveness of the drive will be given in the next semi-monthly narrative report.

#### IV. Inspection and Indexes - Honolulu

##### Summary

No. of premises inspected	44,006
No. of premises breeding Aedes	590
Aedes breeding index	1.3%
No. of premises breeding Culex	190
Culex breeding index	0.4%
No. of inspections per man-day (7-hour day)	42.7

The downward trend of the Aedes breeding index continued during the current period. The present citywide index of 1.3% represents a decrease of 0.5% from the semi-monthly period ending April 30.

Following is a summary by districts of the zone indexes which were reduced, increased and unchanged:

<u>District</u>	<u>Zone Indexes</u>	<u>Zone Indexes</u>	<u>Zone Indexes</u>
	<u>Up</u>	<u>Down</u>	<u>Unchanged</u>
Central	6	22	0
Kapahulu	11	12	1
Lanakila	<u>10</u>	<u>13</u>	<u>2</u>
TOTAL	27	47	3

Ten zones or 13% of the total had indexes above 3% and 8 zones or 10% of the total had indexes above 5%.

# V. Aedes Breeding in Containers By Type

In the table below is given the Aedes breeding index by type of container for the semi-monthly periods from February 1 to the period ending May 15:

<u>Type of Container</u>	<u>Index for Semi-Monthly Periods Ending:</u>						
	<u>2-16</u>	<u>2-29</u>	<u>3-16</u>	<u>3-30</u>	<u>4-16</u>	<u>4-30</u>	<u>5-16</u>
Fish Ponds	.3	1.7	1.9	1.3	1.1	.6	.3
Catch Basins	1.1	.8	1.7	1.4	.9	.0	.4
Cesspools	1.4	.0	.6	1.0	.0	.8	.0
Ditches, Ground Pools	.2	.3	.3	1.2	1.5	.7	.3
Animal Drinking							
Troughs or Pans	.1	.0	.1	.1	.0	.1	.0
Barrels, Tubs, Tanks,							
Jars, Buckets	.3	1.0	1.8	1.9	1.4	.8	.5
Tin Cans, Pans	.3	1.2	2.0	1.7	1.8	1.2	.7
Tires	.5	1.1	2.1	2.6	2.0	1.4	.5
Bottles	.1	.1	.3	.4	.7	.6	.4
Ape Plants	.2	.4	.1	.1	.1	.1	.1
Lily Plants	.8	1.2	1.1	.8	.8	1.0	.7
Ant Cups	1.7	2.1	4.2	2.6	1.9	1.4	1.6
Flower Vases,							
Vine Bowls	1.5	1.4	1.4	1.5	1.6	1.4	1.2
Others	1.8	4.6	7.7	9.4	6.2	2.7	1.6
TOTAL	0.4	0.7	1.2	1.2	1.1	0.7	0.5

It should be noticed that there is a general reflection of the heavy rainfall of early March with increases in the index of almost all types of containers. This is particularly noticeable in the case of breeding in old automobile tires and in the "Others" group. The principal items in this latter group were tree holes, rock holes and other water containers which dry out and usually do not breed, except after heavy rains. The rapid response to the rainfall is undoubtedly due to the presence of viable eggs which hatched immediately on contact with rain water. It is also to be noted that inside breeders such as flower vases and vine-bowls did not show a significant response. The slight increase was probably due to cemetery flower vases which are in the open.

The absence of a greater response to rainfall in the breeding taking place in ape and lily plants is probably due to the familiarity of our inspectors with the locations of these breeders and regular and frequent larvicidal treatment. A contributing factor may be that there is usually a considerable time interval between the rainfall filling the water containing structures and the laying of eggs by the mosquito, since the continued growth of the plant will not permit the carrying over of eggs from a previous wet period.



## VI. Personnel

### A. Honolulu

	<u>Field</u>	<u>Total</u>
Army	140	140
Chamber of Commerce	2	4
U. S. Public Health Service	<u>36</u>	<u>48</u>
TOTAL	178	192

All military personnel formerly assigned to special work crews, with the exception of foremen of clean-up crews, have been recalled to their organizations and replaced with men from a medical sanitary company.

### B. Rural Oahu, Kauai, Maui, Hawaii

#### Army:

Rural Oahu (including Wahiawa)--58  
Kauai--41  
Maui--43  
Hawaii--57

## VII. Public Education

### A. News Releases

Fourteen English and 9 foreign language news releases appeared in the local newspapers during the semi-monthly period.

### B. Public Talks

Two staff members represented the Honolulu Dengue Mosquito Control program on the panel at a round table conference on tropical diseases held under the auspices of the Territorial Medical Association. Approximately 200 members and guests attended this meeting.

### C. Radio

The previous schedule of spot announcements (1-a-day) was continued.

## VIII. Chamber of Commerce Funds

In December, 1943, the Public Health Committee of the Chamber of Commerce had approved a budget of \$5,338.50 for dengue mosquito control work in Honolulu during the period January 1 to June 30, 1944. Disbursements since January 1 have been as follows:

	<u>Allocation</u>	<u>Expenditures</u>
Salaries	\$3912.50	\$1717.33
Transportation	360.00	263.09
Miscellaneous	<u>1066.00</u>	<u>1097.15</u>
TOTAL	\$5338.50	\$3077.57

Balance \$2260.93

As it had been recognized that the allocation for an individual item might be exceeded, although the total sum would be adequate, considerable flexibility in the use of the funds has been allowed.

IX. Resume of Discussion on Dengue Fever Control in Honolulu at Round Table on Tropical Diseases Held Under the Auspices of the Territorial Medical Association

Discussion of the dengue mosquito control program of the Territorial Board of Health commenced with the question relative to its effectiveness. A description of control measures was given and an appraisal made, based on lowered Aedes breeding and dengue fever incidence. It was brought out that this is possibly one of the few times in the history of dengue epidemics that the disease was checked at the outset in a large, densely populated area. It was further remarked that suppression of mosquito breeding was only part of the program. There appeared to be a general agreement as to the importance and successful functioning of the mosquito control program.

The possibility of dengue becoming endemic in Honolulu was discussed. It was brought out that the dengue mosquito control program was designed not only to prevent the epidemic spread of the disease but to eliminate it entirely and that theoretically this could be achieved. In this connection the assumption of a short flight range for Aedes mosquitoes was attacked. It was maintained from the floor that under abnormal wind conditions Aedes mosquitoes could travel significantly long distances. No factual evidence was cited to support this statement for the local species.

Other mosquito-borne diseases were discussed. No definite conclusions were reached relative to the transmission of filariasis in the Territory of Hawaii. The absence of Anophelines and malaria transmission in the Territory was attributed by Dr. Pemberton, Hawaiian Sugar Planters' Association Entomologist, to the inability of the Anophelines in the past to survive the relatively long boat voyage. It was pointed out, however, that in recent years air travel has brought with it the danger of introduction of Anophelines. Rigid control measures to prevent this introduction have been taken. Dr. Pemberton stated that in the past five years examinations of incoming planes have produced the Anopheles mosquito on six occasions.



In one instance the mosquito was alive, although the plane had been routinely sprayed.

#### X. Maui Program

During the period April 16 through 30, 5,550 premises were inspected. The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Haiku	345	44	12.7	21	6.0
Kahului	519	6	1.1	6	1.1
Lahaina	975	78	8.0	28	2.8
Makawao	235	25	10.6	17	7.2
Paia	993	32	3.2	29	2.9
Puunene	995	25	2.5	21	2.1
Spreckelsville	443	12	2.7	8	1.8
Wailuku	1045	67	6.4	27	2.5
TOTAL	5550	289	5.2	157	2.8

The Aedes breeding index for the Island of Maui during the last semi-monthly period in April was 5.2%. This represents a decrease of 5.3% from the previous period. The Aedes breeding index was lowered in all communities on Maui.

Four communities of the eight covered had Aedes breeding indexes above 5%. Five had breeding indexes above 3%.

The dengue mosquito control program on Maui is proceeding more effectively as the inspection crews gain in experience and traveling time between communities shortened by more efficient routes of travel.

#### XI. Kauai Program

In the period April 16 through April 30, 1944, 4,470 premises were inspected.

The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Eleele	88	0	.0	1	1.1
Hanalei	71	6	8.4	2	2.8
Hanamaulu	170	11	6.5	2	1.2
Hanapepe	197	0	.0	2	1.0
Huleia Camp 3	67	5	7.4	0	.0
Kalaheo	283	13	4.5	2	.7
Kapaa	393	17	4.3	2	.5

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Kapaia	73	8	10.9	0	.0
Kealia	197	5	2.5	0	.0
Kekaha	409	18	4.4	2	.4
Kilauea	161	11	6.8	4	2.4
Koloa	526	28	5.3	10	1.9
Koloa Mill	177	8	4.5	3	1.6
Lihue	467	25	5.3	4	.8
Makaweli	167	10	5.9	3	1.7
Nawiliwili	68	6	8.8	1	1.4
Port Allen	120	0	.0	0	.0
Puhi	208	7	3.3	1	.4
Wahiawa	190	2	1.1	2	1.1
Camp #2	60	1	1.7	0	.0
Waimea	378	5	1.3	5	1.3
TOTAL	4470	186	4.2	46	1.0

The Aedes breeding index for the Island of Kauai during this period was 4.2%. This represents a substantial decrease from the index for the previous period when the Aedes breeding index was 9.2%. Every community included in the program with the exception of Kekaha showed a lower Aedes breeding index in the semi-monthly period ending April 30.

The program on Kauai continues to progress in a satisfactory manner. The duration of the inspection cycle is approximately ten days.

### XII. Wahiawa Program

#### Summary

No. of premises inspected	2,277
No. of premises breeding Aedes	10
Aedes breeding index	0.4%
No. of premises breeding Culex	8
Culex breeding index	0.3%
No. of inspections per man-day (7-hour day)	43.8

The citywide Aedes breeding index, 0.4%, for the first semi-monthly period in May represents a decrease of 0.3% from the index for the semi-monthly period ending April 30. Only twelve containers on six premises were found to be breeding Aedes at the 2,277 premises inspected. The progress of the local program is obviously satisfactory.



### XIII. Rural Oahu Program

Six thousand one hundred and ninety-nine premises were inspected during the period May 1 to 15 inclusive. The statistical summary by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Aiea	439	6	1.3	4	.9
Ewa	846	9	1.0	5	.5
Haleiwa	293	1	.3	1	.3
Kahuku	638	2	.3	2	.3
Kailua	1131	16	1.4	2	.1
Kaneohe	722	7	.9	5	.6
Pearl City	422	2	.4	3	.6
Waialua	569	3	.5	2	.3
Waimanalo	282	1	.3	1	.3
Waipahu	837	6	.7	7	.8
TOTAL	6199	53	0.8	32	0.5

The overall Aedes breeding index in rural Oahu was 0.8% during the current semi-monthly period. The Aedes breeding index for the last half of April was 2.0%. The Aedes breeding index for all communities in rural Oahu with the exception of Kahuku decreased during the current period. The index for Kahuku rose from 0.0% to 0.3%. The program in rural Oahu continues to progress in a satisfactory manner.

### XIV. Hawaii Program

Statistical reports have been received from the Island of Hawaii for the semi-monthly periods April 16 to 30 and May 1 to 15, inclusive. The earlier report was not included in the last semi-monthly narrative report.

The breakdown by cities for the semi-monthly period ending April 30 is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Hakalau	225	20	8.8	4	1.7
Hawi	267	0	.0	0	.0
Hilo	4744	217	4.5	94	1.9
Honokaa	386	4	1.0	5	1.2
Honoum	167	10	5.9	4	2.3
Kailua	41	16	39.0	3	7.3
Kamuela	79	0	.0	4	5.0
Kealahakua	243	120	49.3	19	7.8

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Kohala	304	5	1.6	2	.6
Laupahoehoe	127	15	11.8	5	3.9
Mt. View	179	35	19.5	11	6.1
Olaa	442	80	18.0	29	6.5
Ookala	173	18	10.4	7	4.0
Paauihau	187	10	5.3	6	3.2
Pahoa	182	52	28.5	19	10.4
Papaaloa	303	23	7.5	8	2.6
Papaikou	253	32	12.6	10	3.9
Pepeekeo	227	23	10.1	5	2.2
TOTAL	8529	680	7.9	235	2.7

The summary for the first period in May is as follows:

Hakalau	211	8	3.3	5	2.3
Hawi	254	2	.7	1	.3
Hilo	5079	97	1.9	49	.9
Hinokaa	366	2	.5	2	.5
Honoum	229	0	.0	2	.8
Honuaipo	45	1	2.2	0	.0
Kailua	38	3	7.8	1	2.6
Kawaihae	15	1	6.6	0	.0
Kealahoukua	225	19	8.4	6	2.6
Kohala	297	3	1.0	1	.3
Laupahoehoe	59	6	10.1	2	3.3
Mt. View	272	29	10.6	7	2.5
Naalehu	185	3	1.6	0	.0
Olaa	432	23	5.3	7	1.6
Ookala	281	11	3.9	5	1.7
Paauihau	190	3 <sup>rd</sup>	1.5	0	.0
Pahala	388	2	.5	6	1.5
Pahoa	179	12	6.7	2	1.1
Papaaloa	148	3	2.0	4	2.9
Papaikou	288	7	2.4	1	.3
Pepeekeo	235	5 <sup>th</sup>	2.1	2	.8
TOTAL	9416	240	2.5	103	1.0

It appears that the program is proceeding at a very satisfactory rate. The islandwide Aedes breeding index was 7.9% for the last half of April, the same as for the previous period. The index for the first part of May was 2.5%. The Aedes breeding index for the city of Hilo decreased from 4.5% in the latter half of April to 1.9% for the first half of May.

Of the 18 communities covered during the latter part of April, 17 were reinspected during the first half of May. Of these 17 communities, the Aedes breeding index was lower in 16 communities during the first half of May than in the last half of April.



Two clean-up crews operating in Hilo collected and permanently disposed of eight truck loads of tin cans and bottles during the first half of May.

One hundred sixty-three water storage tanks in Olaa and 49 in Mt. View were stocked with mosquito fish during the first half of May.

During the latter part of April, 193 samples were collected from active Aedes breeders in 15 communities on the Island. One hundred eighty-seven of the samples on the emergence of the adult mosquitoes were identified as albopictus. When a sufficient number of samples has been examined, an analysis will be made to determine the presence of specific geographical preferences exhibited by the mosquitoes.

A representative of the Honolulu Dengue Mosquito Control program visited the Island of Hawaii and delivered educational talks at 17 grade, intermediate and high schools in 8 communities. The film, "Life Cycle of the Aedes Aegypti," was shown. Approximately 6,600 children received the benefit of this educational program.

It had originally been intended to enlist the participation of the school children in an inspection program this spring. Due to the short time before the summer recess, however, this school program has been postponed until the fall.

XV. Summary: Territory of Hawaii

No. of premises inspected	80,447
No. of premises breeding Aedes	2,048
Total personnel engaged in program	391

Respectfully submitted,

/s/Bernard B. Berger  
Bernard B. Berger  
P.A. Sanitary Engineer (R)  
i/tc Dengue Mosquito Control





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Sixteenth Semi-Monthly Narrative Report  
Period Ending April 30, 1944

I. Epidemiology

A. Number and Extent of Cases

Five cases of dengue fever were reported during the semi-monthly period ending April 30. This brings the total to date to 1,478 cases. These five cases represent a decrease of 12 cases from the previous semi-monthly period, and is the lowest semi-monthly incidence of the disease since the inauguration of the dengue mosquito control program.

No focus of infection was apparent during this period. Two of the five cases, however, occurred in areas where foci had been present in the past. These areas are River Street and Waikiki. The remaining three cases were located in Nuuanu, Manoa and Aiea.

B. Correlation of Rainfall, Aedes Breeding Index and Dengue Incidence

Included with this report are graphs showing the weekly incidence of dengue cases, by date of onset, the average rainfall in inches and the Aedes breeding index in Honolulu for the seven months period between October, 1943 and April, 1944. These graphs do not cover the period between July, 1943 and September, 1943 in which the dengue incidence first assumed epidemic proportions. Graphs for this earlier period are included in the Narrative Report for the latter half of December, 1943. The graph showing dengue incidence does not include "off shipping" cases.

A definite correlation between rainfall and the Aedes breeding index is apparent, as would be expected. The general downward trend in the Aedes breeding index was interrupted by the rainfall occurring in late November and December. The peak rainfall reported for March 8 was followed by a peak in the Aedes breeding index. The index rose from a value of 1.0% to 3.5%, the highest value recorded since the commencement of the enlarged control program in Honolulu.

lulu. Tree holes, rock holes and other natural potential breeding places were found to be breeding in large numbers following rainfall. The permanent elimination of such containers by filling with cement was a primary cause for the satisfactory drop in the Aedes breeding index following the period of high rainfall. It is interesting to note from the graph that a time lag of two to three weeks occurred between the rise in rainfall and the resulting increase in the breeding index.

A marked decrease in weekly dengue incidence is apparent since October and November, 1943. In the week ending October 19, 159 persons became ill with the disease as compared with four during the week ending April 19, 1944. There is no clear correlation between the number of dengue cases occurring in any period and the Aedes breeding index during that period. Effective epidemiological work, isolation of the patient, elimination of breeders and insecticidal spraying probably account in large measure for this lack of correlation.

## II. Special Work

### A. Wholesale Spraying

One military reservation and two coast guard stations were sprayed during the current period.

### B. Trouble Shooting Crew

The trouble shooting crew sprayed 52 residences, 28 tenements, 24 business establishments, 5 offices, 1 school and 1 USO recreational center in the follow-up of dengue cases.

#### 1. Manhole and Catch Basin Larvicide Work

Storm drains checked	52
" " sprayed	29
" " breeding	23

#### 2. Tree and Rock Hole Filling Work

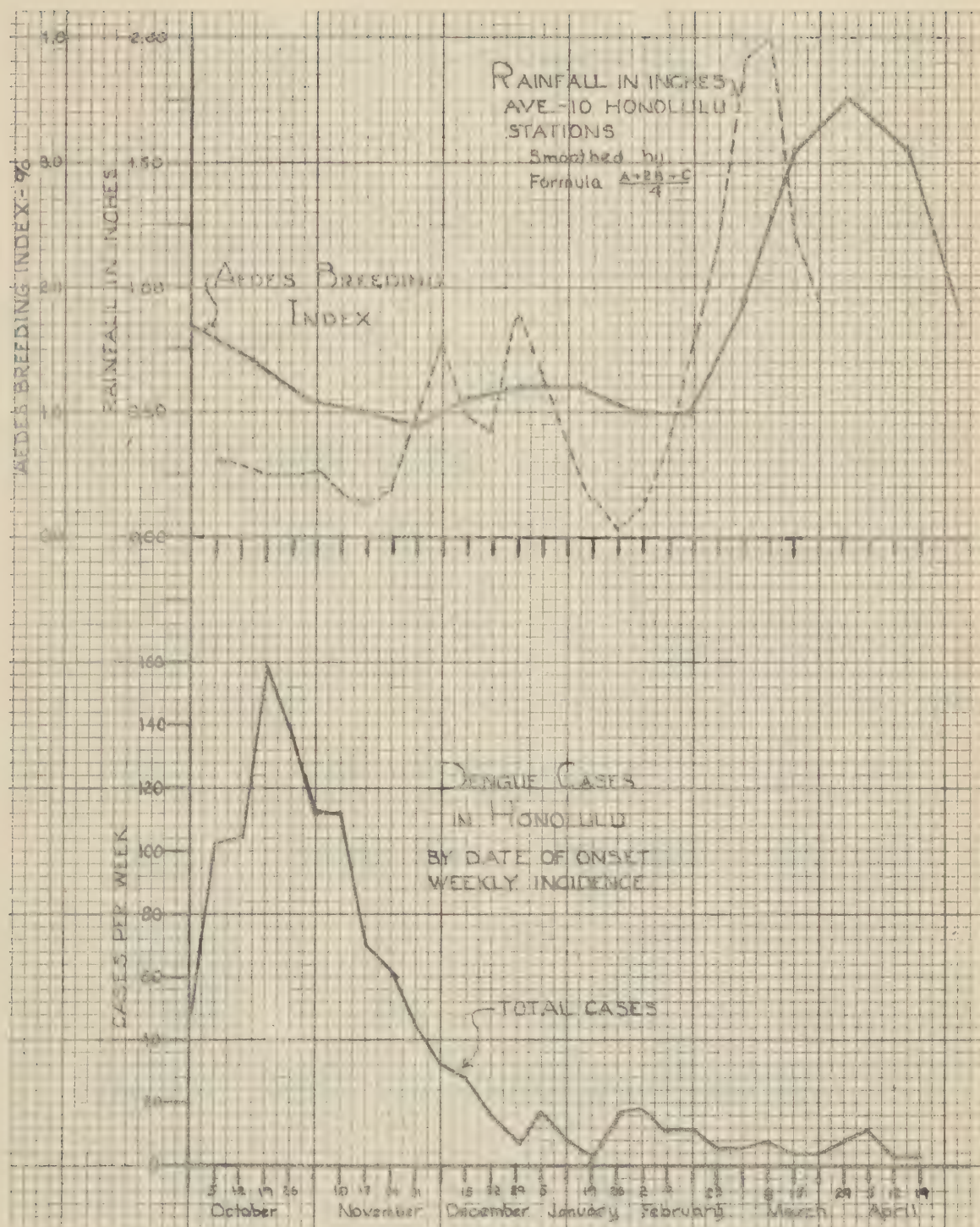
Tree holes filled--987  
Tree holes breeding at the time of filling--31  
Percent breeding--3.1%

Rock holes filled--2,232  
Rock holes breeding at the time of filling--0  
Percent breeding--0

#### 3. Fish Stocking

Fourteen privately owned ponds and one storm ditch were stocked with fish during the period.









4. Miscellaneous control activities included one drainage ditch oiled and forty uncapped vertical pipes filled.

#### C. Roof Gutter Crew

During the period the roof gutter crew cleaned 91 gutters, realigned 9, perforated 8, removed 5 and issued orders to 40 householders to effect permanent correction of their gutters.

#### D. Clean-Up Crew

With an average working force of 35 men utilizing 5 trucks, the clean-up crew collected and disposed of 146 one and one-half ton loads of miscellaneous bottles and tin cans.

### III. Inspection and Indexes

#### Summary

No. of premises inspected	37,873
No. of premises breeding Aedes	713
Aedes breeding index	1.8%
No. of premises breeding Culex	236
Culex breeding index	.6%
No. of inspections per man-day (7-hour day)	41.6

The downward trend of the Aedes breeding index increased more sharply during the current period. The present citywide index of 1.8% represents a decrease of 1.3% from the first semi-monthly period in April.

Following is a summary by districts of the zone indexes which were reduced, increased and unchanged:

<u>District</u>	<u>Zone Indexes</u> <u>Up</u>	<u>Zone Indexes</u> <u>Down</u>	<u>Zone Indexes</u> <u>Unchanged</u>
Central	13	15	0
Kapahulu	5	19	0
Lanakila	<u>5</u>	<u>18</u>	<u>2</u>
TOTALS	23	52	2

Fourteen zones or 18% of the total had indexes above 3%, and eight zones or 10% of the total had indexes above 5%.

### IV. Personnel

A. Honolulu	<u>Field</u>	<u>Total</u>
Army	132	132
Chamber of Commerce	6	7
U. S. Public Health Service	<u>33</u>	<u>42</u>
TOTAL	171	181

B. Rural Oahu, Kauai, Maui and Hawaii

Army:

Rural Oahu (including Wahiawa)--58  
Kauai--41  
Maui--43  
Hawaii--57

V. Public Education

A. News Releases

Six English and 7 foreign language news releases appeared in local newspapers during the semi-monthly period.

B. Public Talks

A paper, "Certain Biological Aspects of Mosquito Control in the Territory of Hawaii," was delivered before the Hawaiian Academy of Science by Assistant Sanitarian (R) David D. Bonnet, entomologist. Approximately 50 members were present.

C. Radio

The previous schedule of radio spot announcements (1-a-day) was continued.

VI. Studies on Distribution of Aedes Aegypti and Aedes Albopictus.  
Abstract of Talk Delivered Before the Hawaiian Academy of Science.

The distribution of Aedes aegypti and Aedes albopictus in the Territory of Hawaii is being studied continuously through regular collections of samples in all controlled areas. At the present time in the City of Honolulu, Aedes albopictus appears to be six times more abundant than Aedes aegypti. Since this proportion was approximately three to one at the beginning of the control program, it would appear that there is a differential effect of our program on these two species. This would be expected in view of the preference of Aedes aegypti for artificial containers, and the greater frequency with which Aedes albopictus breeds in tree holes, spider lilies and other natural containers.

Studies of the distribution of Aedes aegypti and Aedes albopictus in the separate mosquito control inspection zones have shown that the relative proportion varies from 93% aegypti in some zones to 0.4% aegypti in others. There were apparently no aegypti in some areas.



A preliminary survey of rural Oahu and some of the other islands has shown that aegypti is present in the following towns out of 43 towns from which samples were obtained:

Oahu	Waianae, Waipahu, Ewa, Pearl City, Aiea, Honolulu
Kauai	Waimea, Kekaha
Maui	Lahaina
Hawaii	Hilo, Olaa, Pahoa, Honokaa, Kailua, Kealahou

The study of the distribution of these species, Aedes aegypti and Aedes albopictus is being continued. It is possible that one or the other specie may prove to be the better vector for dengue and the information obtained from the study of the distribution of these closely allied species is therefore desirable.

#### VII. Maui Program

During the period April 1 to April 15, 3,971 premises were inspected. The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Haiku	336	86	25.5	37	11.0
Kahului	419	12	2.8	19	4.5
Lahaina	127	29	22.8	15	11.8
Makawao	390	72	18.5	89	22.8
Paia	537	50	9.3	26	4.8
Puunene	911	64	7.0	32	3.5
Sprecklesville	316	16	5.0	8	2.5
Wailuku	809	78	9.6	29	3.5
Waikapu	126	10	7.9	9	7.1

The program on Maui is not yet operating in a thoroughly effective manner. The duration of the inspection cycles is not sufficiently short to allow an effective control of the production of Aedes mosquitoes. The underlying difficulty appears to be a loss of inspection time due to the locations of the cities with respect to each other and resulting time lost in traveling. A more efficient route of travel for inspection crews is being considered and it is expected that in the near future the major difficulties obstructing the progress of the local program will be eliminated.

#### VIII. Kauai Program

A total of 3,779 premises were inspected during the period April 1 to April 15, inclusive. This semi-monthly period is the first

complete period for which a report has been submitted. The program is progressing in a satisfactory manner. The overall Aedes breeding index for the first semi-monthly period in April is 9.2%.

The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Eleele	100	1	1.0	1	1.0
Hanamaulu	163	30	18.4	4	2.4
Hanapepe	175	11	6.2	7	4.0
Kalaheo	117	13	11.8	3	2.5
Kapaa	363	43	11.8	11	3.0
Kapaia	61	8	13.1	5	8.1
Kekaha	354	10	2.8	1	.2
Koloa	213	21	9.8	7	3.2
Lihue	393	42	10.6	6	1.5
Makaweli	167	12	7.1	3	1.7
Nawiliwili	56	14	25.0	3	5.3
Port Allen	121	4	3.3	1	.8
Puhi	229	9	3.9	2	.8
Waimea	345	24	6.9	3	.8

#### IX. Wahiawa Program

##### Summary

No. of premises inspected	1,657
No. of premises breeding Aedes	13
Aedes breeding index	.7%
No. of premises breeding Culex	5
Culex breeding index	.3%
No. of inspections per man-day (7-hour day)	30.7

The Wahiawa citywide Aedes index, 0.7%, for the last half of April indicates a noteworthy reduction in breeding. The highest Aedes breeding index for this community, 9.2%, was recorded for the first semi-monthly period in March. The index for the first half of April was 3.2%. The general container index, 0.1%, is likewise significantly low. The excellent cooperation consistently maintained in Wahiawa undoubtedly is reflected by the low Aedes breeding index. Some credit belongs to the Wahiawa Community Association for its active part in the local program.

#### X. Rural Oahu

Six thousand eighty-nine premises were inspected during the period April 16 through April 30. The statistical summary by cities is as follows:



<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Aiea	251	7	2.7	2	.7
Ewa	834	10	1.1	10	1.1
Haleiwa	309	8	2.5	4	1.2
Kahuku	447			3	.6
Kailua	1379	46	3.3	2	.1
Kaneohe	726	19	2.6	10	1.3
Pearl City	473	7	1.4	5	1.0
Waialua	582	10	1.7	10	1.7
Waimanalo	243	3	1.2	1	.4
Waipahu	845	12	1.4	7	.8

The overall Aedes breeding index in rural Oahu was 2.0% during the current semi-monthly period. The Aedes breeding index for the first half of April was 6.7%. The program in this appears to be progressing in a satisfactory manner. All of the communities covered by this program showed a lower Aedes breeding index in the latter half of April than in the previous period. In some cases the decrease was most substantial. The Aedes breeding index for Waimanalo decreased from 22.2% to 1.2%; that for Kaneohe decreased from 14.4% to 2.6%; and that for Kailua from 10.0% to 3.3%.

#### XI. Hawaii Program

A total of 7,909 inspections were made on the Island of Hawaii during the first semi-monthly period in April. The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Hakalau	55	10	18.1	2	3.6
Hawi	507	15	2.9	13	2.5
Hilo	4480	279	6.2	98	2.2
Honokaa	368	24	6.5	6	1.6
Honolulu	227	21	9.2	12	5.2
Honuaipo	43	1	2.3	1	2.3
Kailua	48	29	60.4	12	25.0
Kamuela	85			8	9.4
Kealahou	252	54	21.4	24	9.5
Kohala	329	12	3.6	8	2.4
Mt. View	317	47	14.8	46	14.5
Naalehu	213	19	8.9	8	3.7
Olaa	124	13	10.4	10	8.0
Pahala	358	15	4.1	15	4.1
Pahoa	177	65	36.7	20	11.2
Papaikou	247	15	6.0	15	6.0
Pepeekeo	79	10	12.6	7	8.8





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Fifteenth Semi-Monthly Narrative Report  
Period Ending April 15, 1944

I. Epidemiology

A. Number and Extent of Cases

Seventeen cases of dengue fever were reported during the semi-monthly period ending April 15. This brings the total to date to 1473 cases. These 17 cases represent an increase of 7 cases over the previous semi-monthly period.

The focus of infection in the Kalihi-uka district which developed during the first half of March was apparently not completely stamped out, 6 cases being located in that area during the current period. Other areas which had previously been listed as foci and which had cases during the last period are as follows: Buckle Lane--1; Kakaako--1; Judd Street--1. Seven other cases were scattered throughout the city.

II. Special Work

A. Wholesale Spraying

The entire area in the Kalihi-uka district previously sprayed was resprayed and an adjacent area of about two square blocks was covered in addition.

B. Trouble Shooting Crew

The trouble shooting crew sprayed 185 residences, 5 business establishments and 2 hotels in the follow-up of dengue cases.

1. Manhole and Catch Basin Larvicide Work

Storm drains	checked	44	
"	"	sprayed	28
"	"	breeding	23

## 2. Tree and Rock Hole Filling Work

Tree holes filled---1277

Tree holes breeding at the time of filling---42

Per cent breeding---3.2%

Rock holes filled---450

Rock holes breeding at the time of filling---84

Per cent breeding---18.6%

## 3. Fish Stocking

Fifty-one pools and streams were stocked with fish during the period.

4. Miscellaneous control activities included 13 ground pools oiled and 2 drainage ditches oiled.

## C. Roof Gutter Crew

During the period the roof gutter crew cleaned 134 gutters, realigned 19, perforated 8 and removed 4 gutters.

## D. Clean-Up Crew

With an average of 34 men and 5 trucks, the clean-up crew picked up and disposed of 100 1-1/2 ton loads and 68 half ton loads of miscellaneous bottles and tin cans.

## III. Cooperation with City County Activities

Recently a report was rendered to Mr. J. F. Kunesh, Chief Engineer, City County Public Works Department, concerning the condition of streams and ditches in Honolulu wherein Aedes and Culex mosquito breeding was noted. In response to this report Mr. Kunesh directed the Public Works Department to utilize three crews of Oahu prisoners (two more than previously) in stream and ditch cleaning activities. A list of 22 areas was established, with first priority given to sections of the water courses where the worst conditions were noted.

## IV. Inspection and Indexes

### Summary

No. of premises inspected	36,890
No. of premises breeding Aedes	1,134
Aedes breeding index	3.1%
No. of premises breeding Culex	277
Culex breeding index	0.7%
No. of inspections per man-day (7-hour day)	40



For the first time since the latter half of January the Aedes breeding index was lower during the current period than during the previous period. The present citywide index of 3.1% represents a decrease of 0.4% from the last half of March. Examination of the daily citywide indexes for the period April 1 through April 15 indicates the daily downward trend of Aedes breeding.

Following is a summary by districts of the zone indexes which were reduced, increased and unchanged:

<u>District</u>	<u>Zone Indexes</u>	<u>Zone Indexes</u>	<u>Zone Indexes</u>
	<u>Up</u>	<u>Down</u>	<u>Unchanged</u>
Central	10	18	0
Kapahulu	9	14	1
Lanakila	8	15	2
TOTALS	<u>27</u>	<u>47</u>	<u>3</u>

Nineteen zones or 24% of the total had indexes above 5%, and 33 zones or 43% of the total had indexes above 3%.

#### V. Personnel

##### A. Honolulu

	<u>Field</u>	<u>Total</u>
Army	146*	146
Chamber of Commerce	9	10
U.S. Public Health Service	<u>33</u>	<u>40</u>
	188	196

##### B. Rural Oahu, Kauai, Maui and Hawaii

###### Army:

Rural Oahu (including Wahiawa)--58  
 Kauai--41  
 Maui--43  
 Hawaii--57

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\*Includes new group of soldiers assigned for training.

## VI. Public Education

### A. News Releases

Six English and three foreign language news releases appeared in local newspapers during the period. In addition, papers from the outside islands carried stories of newly inaugurated control programs there.

### B. Public Talks

A lecture was given and a film shown to 750 students at Waialua High School.

### C. Radio

The previous schedule of radio spot announcements (1-a-day) was continued.

## VII. Wahiawa Program

### Summary

No. of premises inspected	1,057
No. of premises breeding Aedes	34
Aedes breeding index	3.2%
No. of premises breeding Culex	15
Culex breeding index	1.4%
No. of inspections per man-day (7-hour day)	22.4

The Wahiawa citywide Aedes index for the current period is .9% lower than the previous period and is less than half of that of one month ago.

A committee representing the Wahiawa Community Association, working as a contact group, has been able to persuade local residents to clean up serious accumulations of tin cans, bottles and other debris, thereby obviating the necessity of assigning a clean-up crew in that city. The spirit of local cooperation has been excellent.

## VIII. Maui Program

The second semi-monthly (March 16 through 31) report has been received from the Island of Maui. Thus far the cities of Lahaina and Paia have shown the heaviest concentrations of Aedes breeding. Regarding the types of containers, it has been found that tires, vine bowls, flower vases and ant cups have the highest container indexes at the present time. A total of 3,424 premises were inspected during the current period.



The breakdown by cities covered during the period is as follows:

City	<u>No.</u>	<u>Prem.</u>	<u>Aedes</u>	<u>Prem.</u>	<u>Culex</u>
	<u>Prem.</u>	<u>Breed.</u>	<u>Breed.</u>	<u>Breed.</u>	<u>Breed.</u>
	<u>Insp.</u>	<u>Aedes.</u>	<u>Index.</u>	<u>Culex</u>	<u>Index</u>
Lahaina	830	230	27.7	86	10.4
Paia	1052	144	13.6	104	9.8
Spreckelsville	323	27	8.3	32	9.9
Wailuku	1219	107	8.7	133	10.9

#### IX. Rural Oahu Program

During the period April 1 through April 15, 6,179 premises were inspected. The breakdown by cities is as follows:

City	<u>No.</u>	<u>Prem.</u>	<u>Aedes</u>	<u>Prem.</u>	<u>Culex</u>
	<u>Prem.</u>	<u>Breed.</u>	<u>Breed.</u>	<u>Breed.</u>	<u>Breed.</u>
	<u>Insp.</u>	<u>Aedes</u>	<u>Index</u>	<u>Culex</u>	<u>Index</u>
Aiea	667	31	4.6	12	1.7
Ewa	778	19	2.4	13	1.6
Haleiwa	306	20	6.5	23	7.5
Kahuku	371	8	2.1	6	1.6
Kailua	736	74	10.0	8	1.0
Kaneohe	955	138	14.4	12	1.2
Pearl City	756	37	4.8	16	2.1
Waialua	574	28	4.8	15	2.6
Waimanalo	184	41	22.2	5	2.7
Waipahu	852	19	2.2	18	2.1

Analysis of the cycle of inspection indicates that the cities in windward Oahu are now on an inspection cycle of slightly under ten days while leeward Oahu has a cycle of approximately thirteen days. Adjustments in the latter will be made as inspection crews become more familiar with their assigned cities.

#### X. Hawaii Program

During the period March 16 through March 31 a total of 10,224 inspections was made on the Island of Hawaii. Of these 6,419 were in Hilo.

The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Hakalau	183	12	6.5	7	3.8
Hilo	6419	344	5.3	136	2.1
Honokaa	394	44	11.1	29	7.3
Honolulu	231	19	8.2	9	3.8
Honuaipo	106	3	2.8	5	4.7
Kailua	46	11	23.9	8	17.3
Kamuela	79	2	2.5	10	12.6
Kealahou	209	71	33.9	46	22.0
Kohala	328	41	12.5	12	3.6
Mt. View	315	67	21.2	54	17.1
Naalehu	207	21	10.1	9	4.3
Olaa	713	103	14.4	58	8.1
Pahala	429	18	4.1	17	3.9
Pahoa	176	53	30.1	36	20.4
Papaikou	276	21	7.6	9	3.2
Pepeekeo	83	8	9.6	6	7.2
Wailea	30	2	6.6	1	3.3

#### XI. Kauai Program

The two crews doing inspection work on the Island of Kauai completed their established lists of assigned cities within a period of 14 days elapsed time on the first cycle of inspection. Increased familiarity with the cities under inspection will undoubtedly reduce the inspection cycle subsequently to approximately 10 days.

During the initial period March 27 through March 31 a total of 1,322 premises were inspected. The breakdown by cities is as follows:

<u>City</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Eleele	60	1	1.6		
Hanapepe	171	22	12.8	4	2.3
Kekaha	404	32	7.9	14	3.4
Makaweli	131	17	12.9	5	3.8
Port Allen	118	4	3.3		
Wahiawa	143	9	6.3	3	2.1
Waimea	295	44	14.9	13	4.4



XII. Summary: Territory of Hawaii

No. of premises inspected	59,096
No. of premises breeding Aedes	3,060

Respectfully submitted,

/s/ Wesley E. Gilbertson

Wesley E. Gilbertson  
P. A. Engineer (R)  
i/c Dengue Mosquito Control





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Fourteenth Semi-Monthly Narrative Report  
Period Ending March 31, 1944

I. Epidemiology

A. Number and Extent of Cases

During the semi-monthly period ending March 31, 10 cases of dengue fever were reported, bringing the total to date to 1456 cases. Twelve cases were reported during the first half of March, thus making 22 cases for March.

Of the 10 cases reported during the last half of the month, 3 occurred in the Kalihi-uka district on Kamaikai Street, 2 in the Kaluwahine Homestead area and the remainder were scattered.

Cases "off shipping" from the Southwest Pacific continue to be reported throughout the Hawaiian Islands.

- B. Records of the first 1300 dengue cases have now been set up on punch cards and preliminary analysis completed. Of these cases, approximately 60% were among females and 40% among males. It appears that about two-fifths of the cases were probably contracted at the place of occupation and about three-fifths at the place of residence. Cases which occurred in the same zone and on the same street as one or more previous cases, i. e., "multiple cases" ran about 70%.

Fifty per cent of the dengue cases were reported before 2-1/2 days after onset, 57% before three days, 73% before four days and 90% before six days. Most of the lag in reporting is due to delay in calling a physician. Many physicians are at present phoning their reports to the Bureau of Communicable Diseases. The infectious stage of dengue begins about one day prior to onset and extends three or four days after onset. Patients are always placed under bed nets and the premises sprayed within one day after reporting, but on the basis of the lag in reporting indicated above, nearly three-fourths of the cases are past the infectious stage before the isolation technique is made effective; hence, a great importance is attached to adult mosquito destruction by spraying.

Other data such as statistics on symptomology, age distribution, correlation with mosquito indexes and correlation with population densities are being worked out for later presentation in detail along with the above data.

## II. Special Work

### A. Trouble Shooting Crew

During the period the trouble shooting crew in the follow up of dengue cases sprayed 89 residences, 3 tenements, 7 institutions and 6 business establishments.

#### 1. Manhole and Catch Basin Larvicide Work

Storm drains checked	204
" " sprayed	31
" " breeding	9

#### 2. Tree and Rock Hole Filling Work

Tree holes filled--1840  
Tree holes breeding at the time of filling--145  
Per cent breeding--7.8%

Rock holes filled--119  
Rock holes breeding at the time of filling--12  
Per cent breeding--10.0%

#### 3. Miscellaneous control activities included 3 drainage ditches larvicided, one ship sprayed and 222 vertical pipes in the ground filled.

### B. Roof Gutter Crew

During the period the roof gutter crew worked on the gutters of 130 premises. Ninety-one gutters were cleaned out, 22 repaired, 15 perforated and 2 removed.

### C. Clean-Up Crew

The clean-up crew collected and disposed of 274 half-ton and 22 one and one-half ton truck loads of water-holding containers during the period.

### D. Fish Stocking

During the month of March, 9 fish ponds and a swimming pool were stocked with mosquito destroying minnows in the Kapahulu district.



### III. Inspection and Indexes

#### Summary

No. of premises inspected	37,094
No. of premises breeding Aedes	1,332
Aedes breeding index	3.5%
No. of premises breeding Culex	301
Culex breeding index	0.8%
No. of inspections per man-day (7-hour day)	36.9

The Aedes breeding index in Honolulu continued to rise during the last half of March but the increase in breeding appeared to be slowing down. A great many natural mosquito breeding places, such as rock and tree holes--previously dry--have become filled with water and are now breeding.

The rise in the Aedes index is also undoubtedly partly due to an increase in proficiency of the inspectors. It has been observed that the types of breeders found recently are such that they could easily escape the attention of a less experienced inspector. A majority of the presently assigned inspectors have three months or more experience, thereby providing a greater period for learning the work.

Following is a summary by districts of the zone indexes which were reduced, increased and unchanged:

	<u>Zone Indexes</u>	<u>Zone Indexes</u>	<u>Zone Indexes</u>
<u>District</u>	<u>Up</u>	<u>Down</u>	<u>Unchanged</u>
Central	15	13	0
Kapahulu	18	6	0
Lanakila	17	7	1
TOTALS	50	26	1

Twenty-four zones or one-fourth of the total, had indexes above 5% and 38 zones or one-half of the total, had indexes above 3%.

Special inspections were made in 7 cemeteries in which 470 containers were checked. Of these, 39 or 8.3% were breeding.

### IV. Personnel

#### A. Honolulu

	<u>Field</u>	<u>Total</u>
Army	146*	146
Chamber of Commerce	7	8
U.S. Public Health Service	37	45
TOTALS	190	199

\*Includes new group of soldiers assigned for training.

B. Rural Oahu, Kauai, Maui and Hawaii

Rural Oahu*	58
Kauai	41
Maui	43
Hawaii	57

(A portion of the total company strength on Hawaii and in rural Oahu are assigned to company maintenance duty.)

V. Public Education

A. Public Talks

The following public talks were given during the period:

Attendance

Rotary Club, Wailuku, Maui	40
Rotary Club, Hilo, Hawaii	50

B. News Releases

Thirteen English news releases appeared in the local newspapers and 10 in foreign language newspapers.

C. Radio

Fourteen radio spot announcements were broadcast on a 1-a-day basis during the past period.

VI. Public Health Service Expenditures for the Past Quarter Year

<u>Month</u>	<u>Salaries</u>	<u>Supplies</u>	<u>Equipment</u>	<u>Miscellaneous</u>
January	\$7794.09	\$630.96	\$623.57	
February	7866.47	748.83	808.12	\$172.34
March	8096.70	176.51	48.30	85.64
TOTALS	\$23,757.26	\$1,556.30	\$1,479.99	\$257.98

GRAND TOTALS—\$27,051.53

The grand total for the period September 1 to December 31, 1943 was \$33,308.79.

\*Includes 5-man inspection crew at Wahiawa assigned from Honolulu.



## VII. Wahiawa Program

### Summary

No. of premises inspected	934
No. of premises breeding Aedes	39
Aedes breeding index	4.1%
No. of premises breeding Culex	11
Culex breeding index	1.1%
No. of inspections per man-day (7-hour day)	26.7

The Wahiawa citywide Aedes index for the previous period was 9.2%. It appears, therefore, that the increase in Aedes breeding in Wahiawa has been suppressed and the situation is under control. Excellent cooperation has been received from the residents of Wahiawa in cleaning up the area.

## VIII. Maui Program

Reports have been received from the control program on the Island of Maui, covering the period March 7 to 15. During this period a total of 2024 premises were inspected. The breakdown by cities is as follows:

<u>Cities</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Kahului	364	17	4.6	20	5.4
Puunene	966	18	8.1	62	6.4
Spreckelsville	158	16	10.1	17	10.7
Waikapu	126	5	3.9	24	19.0
Wailuku	410	26	6.4	36	8.8

## IX. Rural Oahu Program

The Aedes control program in rural Oahu began operating on a stabilized personnel basis on March 23. During the period March 23 to 31 a total of 2625 premises were inspected. The breakdown by cities is as follows:

<u>Cities</u>	<u>No.</u> <u>Prem.</u> <u>Insp.</u>	<u>Prem.</u> <u>Breed.</u> <u>Aedes</u>	<u>Aedes</u> <u>Breed.</u> <u>Index</u>	<u>Prem.</u> <u>Breed.</u> <u>Culex</u>	<u>Culex</u> <u>Breed.</u> <u>Index</u>
Aiea	408	32	7.8	10	2.4
Ewa	754	37	4.9	33	4.3
Kaneohe	508	41	8.0	16	3.1
Pearl City	180	13	7.2	5	2.8
Waipahu	775	15	1.9	9	1.1

X. Hawaii Program

The control operations on the Island of Hawaii began operations on March 13. Statistical reports have not been received as yet.

XI. Kauai Program

The Aedes control program on the Island of Kauai began operations on March 27. The cities to be placed under control were divided into two groups and assigned to inspection crews as follows:

<u>Crew 1</u>	<u>Crew 2</u>
Waimea	Kekaha
Port Allen	Kalaheo
Eleele	Makaweli
Hanapepe	Wahiawa (McBryde Mill)
Koloa Village Proper	Koloa Mill Village
Lihue	Hanamaulu
Puhi	Nawiliwili
Kapaa	Kapaia
Hanalei	Kealia
	Kilauea

Respectfully submitted,

/s/ Wesley E. Gilbertson

Wesley E. Gilbertson  
P. A. Engineer (R)  
i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Thirteenth Semi-Monthly Narrative Report  
Period Ending March 15, 1944

I. Epidemiology

A. Number and Extent of Cases

Twelve cases of dengue fever were reported during the semi-monthly period ending March 15. This brings the total to date to 1446 cases. The lowest number of cases previously reported for a half month period was 17, since the peak of the epidemic.

One focus developed--in the Kalihi-uka district--on Merkle and Kamanaiki Streets. Other cases were scattered throughout the city, one being in the Buckle Lane area, one near Kakaako, three scattered in Kalihi and one on Round Top.

II. Special Work

A. Wholesale Spraying

The focus of infection which occurred in the Kalihi-uka area was given wholesale spraying treatment. An area of approximately two blocks comprised of 75 premises were sprayed, both interior and exterior.

B. Trouble Shooting Crew

During the period the trouble shooting crew in the follow-up of dengue cases sprayed 74 residences, 34 bomb shelters and 5 large institutions.

1. Manhole and Catch Basin Larvicide Work

Storm drains checked	132
" " sprayed	78
" " breeding	3

Water, gas, electric and telephone manholes checked	31
" " " " " " sprayed	3
" " " " " " breeding	none

## 2. Tree and Rock Hole Filling Work

Tree holes filled--216

Tree holes breeding at the time of filling--74

Per cent breeding--34.2%

Rock holes filled--1335

Rock holes breeding at the time of filling--83

Per cent breeding--6.2%

3. Miscellaneous control activities included: 16 swampy areas, 5 cesspools and 3 drainage ditches larvicided with oil; 2 water tanks and a stream stocked with Gambusia minnows.

### C. Roof Gutter Crew

The roof gutters of 77 houses were permanently corrected.

### D. Clean-Up Crew

The clean-up crew collected and disposed of 232 truck loads of cans, bottles and other water-holding containers. The previously used Moilili dump was closed for this purpose and the longer haul to the Apili dump reduced the amount of material disposed of during the current period.

## III. Inspection and Indexes

### Summary

No. of premises inspected	29,057
No. of premises breeding Aedes	913
Aedes breeding index	3.1%
No. of premises breeding Culex	339
Culex breeding index	1.1%
No. of inspections per man-day (7-hour day)	35.8

The Honolulu citywide Aedes breeding index increased during the first half of the month from 1.9% to 3.1%. Heavy rainfall conditions are continuing and it is difficult to predict the trend in Aedes breeding. Enough rainfall is being experienced in the form of intermittent showers to reduce the number of inspections made per man-day from 45 for the previous period, to 35 for the current period.

Following is a summary by districts of the zone indexes which were reduced, increased and unchanged:

<u>District</u>	<u>Zone Indexes</u> <u>Up</u>	<u>Zone Indexes</u> <u>Down</u>	<u>Zone Indexes</u> <u>Unchanged</u>
Central	23	5	0
Kapahulu	18	5	1
Lanakila	12	8	5
TOTALS	53	18	6



Sixteen zones, or one-fifth of the total, had indexes above 5% and 31 zones, or two-fifths of the total, had indexes above 3%.

A special survey of approximately 1200 premises was made by the foremen, giving a cross-section picture of the entire city. The purpose of this special survey was to determine whether an accurate index was being provided by the inspection reports of the regular inspectors.

Analysis of the reports by the foremen in comparison with those by the regular inspectors during the identical period showed that the regular inspectors are missing many breeders, and the actual Aedes breeding index is somewhat higher than that indicated.

#### IV. Personnel

A. Honolulu	<u>Field</u>	<u>Total</u>
Army	78	78
Chamber of Commerce	11	12
U. S. Public Health Service	38	47
TOTALS	127	137

#### B. Rural Oahu, Maui and Hawaii

Rural Oahu*	112
Maui	43
Hawaii	63

#### V. Public Education

- A. A special \$500 budget request was approved by the Public Health Committee of the Honolulu Chamber of Commerce for public education activities. The increased rainfall and mosquito breeding has made it desirable to inaugurate an increased publicity campaign for public cooperation with inspection activities. The funds will be spent for pamphlets, radio spot announcements and direct mail contacts.

#### B. News Releases

During the period 18 news releases appeared in the local English newspapers and 10 in foreign language newspapers.

\*  
Kauai detachment still on Oahu; also includes Wahiawa crew assigned from Honolulu.

### C. Radio

The regular Board of Health program, "How to Keep Well" was devoted to dengue control on March 12.

## VI. Wahiawa Program

### Summary

No. of premises inspected	722
No. of premises breeding Aedes	67
Aedes breeding index	9.2%
No. of premises breeding Culex	3
Culex breeding index	0.4%
No. of inspections per man-day (7-hour day)	24.9

The increase in the Wahiawa Aedes breeding index represents a 50 % rise over the previous period. Through the efforts of the inspectors and foremen, a great many dumps of cans, bottles and other receptacles are being removed. However, it may be necessary to assign additional manpower to this work, if such can be made available.

## VII. Training in Rural Oahu

After completion of a brief training course in Honolulu, the two colored medical sanitary companies were assigned for a temporary period to Aedes control activities in rural Oahu. Eleven 6-man inspection crews with foremen and sub-foremen were selected on the basis of written examinations and ratings made while in the field training course. The remainder of the companies (with the exception of those needed for company maintenance duty) were divided into clean-up crews.

The cities of Kaneohe, Kailua, Kahuku and Waimanalo were placed under the crews of one company and the cities of Aiea, Ewa, Waialua, Pearl City, Haleiwa and Waipahu were placed under the crews of the second company. Although the work was considered to be an extension of the training activity, complete records were maintained and indexes computed. As of the end of February these cities showed the following indexes as calculated from reports provided by these inspections:

Aiea	2.8
Ewa	2.8
Haleiwa	2.0
Kahuku	2.5
Kailua	4.6
Kaneohe	20.6
Pearl City	1.9
Waialua	2.5
Waimanalo	1.4
Waipahu	1.7
Waianae	2.2



Due to the somewhat untrained status of these inspectors, these indexes are considered lower than the actual breeding conditions. In addition to the inspection work, the clean-up crews were put to good use in cleaning up bad areas located in the above cities.

#### VIII. Maui Program

During the current period the mosquito control detachment of 42 men and one officer inaugurated Aedes control on the Island of Maui. The men are divided into two inspection crews and two clean-up crews. For purposes of inspection, the cities on Maui have been divided into two groups, each of which will be the responsibility of one inspection crew.

<u>Crew 1</u>	<u>Crew 2</u>
Puunene	Kahului
Sprecklesville	Waikapu
Paia	Wailuku
Haiku	Lahaina
Makawao	

The clean-up crews will be transferred from city to city depending on clean-up needs.

The army has provided the following transportation:

Four 1 1/2 ton cargo trucks  
One jeep

#### IX. Hawaii Program

The mosquito control company of 61 men plus 2 officers were transferred to Hawaii during the period. The men assigned to mosquito control duty are divided into four inspection crews and two clean-up crews.

It is anticipated that two inspection crews will be needed constantly in Hilo, which is considered the second largest city in the Territory. The other cities on Hawaii which will be under control were divided into two groups as follows:

<u>Crew 1</u>	<u>Crew 2</u>
Pahala	Hawi
Honuapo	Kohala
Naalehu	Honokaa
Olaa	Kealahkekua
Mt. View	Kailua
Pahoa	Kamuela

Other smaller cities and plantation camps will receive inspection service occasionally as time permits.

The clean-up crews will work initially in Hilo, and later in other cities where the need is greatest.

The army furnished the following transportation:

Five 1/2-ton weapon carrier trucks

Three 1 1/2-ton cargo trucks

Two jeeps

Respectfully submitted,

/s/ Wesley E. Gilbertson  
Wesley E. Gilbertson  
P. A. Engineer (R)  
i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Twelfth Semi-Monthly Narrative Report  
Period Ending February 29, 1944

I. Epidemiology

A. Number and Extent of Cases

During the semi-monthly period ending February 29, 18 cases of dengue fever were reported, bringing the total number to date to 1,434. The number of cases reported during the last half of February was approximately half that was reported for the first half of the month, but was higher than the number reported for the last half of January.

The cases resided in scattered areas throughout the city and no important focal point of infection could be determined.

Two or three cases occurred at places which had previously been danger spots but now appear to be dying out.

B. Epidemiology on Recent Kauai Case

Because most dengue patients do not remember when they were bitten by mosquitoes prior to the onset of the disease, and practically none of the patients can give the date they received the disease-transmitting mosquito bite, it is difficult to determine the incubation period of dengue except under certain conditions.

In a recent semi-monthly report a case of dengue was reported from the Eleele Camp on the island of Kauai; also a suspected case of dengue which had occurred previously in the same household. Additional information has been secured regarding these cases which indicates that the suspected case was dengue, contracted in Honolulu, and had an incubation period of over 14 days. The length of the incubation period makes the case worthy of note. Following is the information received on these cases:

1. On November 2, Mr. Masayuki Nishi, 18, 250-C N. Beretania Street, Honolulu, T. H. came down with dengue. He was ill until November 9.
2. On the morning of November 27, twenty-five days later, Hiromi Nakagawara, who had been residing at 250 N. Beretania Street, Honolulu, departed for Kauai, arriving at his home, House 49, Eleele Camp, the same day.
3. He took sick on the eve of December 11, was admitted to Eleele Hospital on December 13, with diagnosis of "flu" and discharged on December 16. He later reported having had a rash on his arms. A period of 14 1/2 days elapsed from the date of his departure from Honolulu until the onset of his sickness on December 11.
4. On December 21 Henry Nakagawara, 14, residing in House 49, Eleele Camp, took sick with a slight temperature. He was hospitalized on December 22, temperature 100.6°. On December 23 the temperature was 103° and the patient had a rash. The case was diagnosed as dengue.
5. All usual precautions were taken, including covering the patient with a mosquito net, spraying of interiors and exteriors of all buildings within a five hundred foot radius of the patient's home and inspections to eliminate mosquito breeding. No further cases occurred.

In view of the above facts, it appears that Hiromi Nakagawara had dengue, not "flu," and was the connecting case which brought the dengue from Honolulu to Eleele Camp. The incubation period (14 1/2 days) is one of few which can be definitely ascertained and is the longest of which we have a record.

## II. Special Crews

### A. Trouble Shooting Crew

During the period the trouble shooting crew, in the follow-up of dengue cases, sprayed 230 residences, 18 institutions, 6 business establishments and 3 hotels.

Following is a resume of manhole and catch basin larvicide work:



Storm drains checked	273	
Storm drains sprayed	156	
Storm drains breeding	1	
Water, gas, electric and telephone manholes checked		136
Water, gas, electric and telephone manholes sprayed		11
Water, gas, electric and telephone manholes breeding		none

During the period a new service was started as part of the work of the trouble shooting crew, consisting of filling rock and tree holes with neat cement. This is a permanent corrective work. Its immediate value is attested by the number of such holes which were actually found breeding just prior to the filling operation. Below is a summary of the work completed during the four days of operation of this service:

Rock holes filled	599
" " breeding	44
Percent breeding	7.7%
Tree holes filled	15
" " breeding	6
Percent breeding	40%

#### B. Fish Planting

Top-feeding mosquito minnows were planted in four fish ponds and one animal watering trough during the period. The stream which passes through Waialae Golf Course, where minnows had been planted previously, was checked and it was found that the fish had died due to the polluted condition of the water. The breeding areas will be oiled as necessary.

#### C. Roof Gutter Crew

The roof gutters on 59 buildings were checked and permanent corrections made.

#### D. Clean-Up Crew

The clean-up crew collected and disposed of 316 loads of water-holding receptacles. The work of this crew has been distributed throughout all areas of the city.

#### E. Larviciding--Culex Control

Two days were spent in spraying low-lands in Manoa Valley with larvicide oil to control Culex breeding places.

### III. Inspection and Indexes

#### Summary

Number of premises inspected	35,629
Number of premises breeding Aedes	681
Aedes breeding index	1.9%
Number of premises found breeding Culex	104
Culex breeding index	0.2%
Number of inspections per man-day (7-hour day)	45.1

The Honolulu citywide Aedes breeding index increased from 1.0% for the first half of February to 1.9% for the last half, reflecting the greatly increased rainfall which is occurring. The current Aedes index is the highest encountered since the beginning of the augmented control program in September. However, earlier records of the Chamber of Commerce mosquito control work indicate that a higher breeding index existed in August prior to the serious increase in dengue cases, beginning in September.

Analysis of the trend of the indexes in the various types of breeders indicates that while flower vases and vine bowls--which are interior breeders--have continued to decrease, fish ponds, jars, pails, tin cans, tires and ant cups are responsible for most of the increase which has occurred.

Six zones, three in the Lanakila district and three in the Central district had indexes above 5%. Fourteen zones, or 18% had indexes above 3%.

Following is a summary by districts of the zone indexes which were reduced, increased and unchanged:

<u>District</u>	<u>Zone Indexes</u>	<u>Zone Indexes</u>	<u>Zone Indexes</u>
	<u>Up</u>	<u>Down</u>	<u>Unchanged</u>
Central	17	9	1
Kapahulu	12	8	4
Lanakila	16	6	3
TOTALS	<u>45</u>	<u>23</u>	<u>8</u>

A special survey of all rivers and streams in the city was started. Accumulations of tin cans, bottles and other miscellaneous containers were noted on the banks and in the dry stretches of the stream beds. Many of these containers were filled with water and breeding Aedes mosquitoes. A crew of prisoner labor under City County supervision has been cleaning a portion of Pauoa Stream and it is hoped that this activity will be extended to include other troublesome stretches of streams.



#### IV. Personnel

##### A. Total Personnel

As of February 29 the following personnel were on duty on the Honolulu and Wahiawa programs:

	<u>Field</u>	<u>Total</u>
Army	99	99
Chamber of Commerce	12	13
Public Health Service	39	48
TOTALS	<u>150</u>	<u>160</u>

The two colored medical sanitary companies have almost completed their temporary assignment on Aedes control in war-connected communities in rural Oahu and are ready for transfer to the outside islands.

#### V. Public Education

##### A. News Releases

During the period eleven news releases appeared in the local English newspapers and eight in foreign language newspapers.

#### VI. Staff Training

A complete program of orientation and education in mosquito-borne diseases and their control has been started for the staff assigned to the Honolulu program. A special lecture each week is being delivered at each of the three district offices. Appropriate charts and movie films are also being included.

#### VII. Wahiawa Program

##### Summary

Number of premises inspected	993
Number of premises breeding Aedes	64
Aedes breeding index	6.4%
Number of inspections per man-day (7-hour day)	29.2

The situation at Wahiawa reflects the serious increase in rainfall as in Honolulu.

During the period an additional inspector was assigned to the Wahiawa program for special duty in connection with roof gutter work.

Respectfully submitted,

/s/ Wesley E. Gilbertson

P.A. Engineer (R)

i/c Dengue Mosquito Control





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

Eleventh Semi-Monthly Narrative Report  
Period Ending February 15, 1944

I. Epidemiology

A. Number and Extent of Cases

During the semi-monthly period ending February 15, 37 cases of dengue fever were reported, bringing the total number to date to 1416. The increase in cases noted towards the end of January continued during the first half of February.

One focus developed, probably beginning with unreported cases, near Iolani School on Judd Street in lower Nuuanu Valley. At least ten cases have developed there to date. Two cases were reported from the Kakaako district and the others were scattered throughout the city.

The prospect of early eradication of dengue fever from Honolulu is not good at the present moment. This is due, among other things, to the difficulty in obtaining prompt and complete reporting of cases and to the difficulty in reducing the citywide Aedes breeding index much below one percent as yet. Many newspaper articles have been published and radio announcements have been broadcast urging people to call a physician or the Board of Health immediately upon the appearance of symptoms, but often this is not done, thereby preventing follow-up control of the cases. With respect to the Aedes breeding index, it is possible that current increase in dengue cases may be due in part to an increase in mosquito population which was reflected by a higher index after the rains early in December.

II. Wholesale Spraying

The above-mentioned focus of infection in Nuuanu Valley received a thorough treatment by spraying inside and outside of all buildings and around the yards to eliminate all mosquitoes. The area comprised of about two square blocks.

A one-block area around Willard Inn in Waikiki was also sprayed.

### III. Special Crews

#### A. Trouble Shooting Crew and Catch Basin Spraying

Two hundred thirty residences were sprayed in the follow-up of dengue cases; also 12 business establishments, 5 institutions and 18 hotels and apartments.

Following is a resume of catch basin and manhole checking and spraying activities:

Storm drains checked	362
Storm drains oiled	189
Storm drains breeding	5
Water, gas, telephone and electric company manholes checked	213
Water, gas, telephone and electric company manholes oiled	48

#### B. Roof Gutter Crew

During the half month period 121 buildings with faulty roof gutters were checked, of which 101 received permanent correction.

#### C. Clean-up Crew

A total of 347 truck loads of miscellaneous containers were collected and hauled to disposal sites.

#### D. Larviciding--Culex Control

In the Damon Tract a ditch carrying septic tank effluent from a military establishment overflowed and flooded nearby residential areas along a four-block stretch. These places, together with the ditch itself, were sprayed for Culex control. Oil drip cans were tried but were not completely successful. Gambusia minnows have been introduced in the attempt to aid the control activities.

The low land in the Moilili stone quarry was sprayed with a power sprayer, after which minnows were introduced for Culex control.

A swampy pasture land area of about two acres, located in the Manoa Valley was sprayed with the power sprayer and supplementary work was done with knapsack sprayers in covering small ground holes and hoof prints. This area is located within a good residential district.





Dengue Mosquito Inspector treating a spider lily plant (*Crinum* sp.) with larvicide. The initial *Aedes* breeding index for lily plants was 4.2% and is now 0.4% (Photo by Signal Corps, U. S. Army)



The aye plant (*Alocasia* sp.) is another tropical plant which collects water at the base of the leaf stem. Many of these plants have been cut off at ground level, others treated with larvicide. The present index is 0.2% (Photo by Governor's "Work to Win" Program)





#### IV. Inspection and Indexes

##### A. Summary

Number of premises inspected	41,231
Number of premises found breeding Aedes	439
Aedes breeding index	1.0%
Number of premises found breeding Culex	83
Culex breeding index	0.2%
Number of inspections per man-day (7 hour day)	46.6

The Honolulu citywide Aedes and Culex breeding indexes remained at the same level during the first half of February as they were during the last half of January. The increase in rainfall recently experienced occurred during the last part of the current semi-monthly period and has not as yet affected the mosquito breeding indexes.

Four zones, two in the Lanakila district and two in the Central district, had indexes above 5 percent. Six zones or 9 percent had indexes above 3 percent.

Following is a summary by districts of zone indexes which were reduced, increased and unchanged:

<u>District</u>	<u>Zone Indexes</u>	<u>Zone Indexes</u>	<u>Zone Indexes</u> <u>Unchanged</u>
	<u>Up</u>	<u>Down</u>	
Central	14	13	1
Kapahulu	11	8	5
Lanakila	12	9	4
TOTALS	37	30	10

##### B. Analyses of Aedes Breeding in Containers by Type

There is tabulated below the Aedes breeding indexes by type of container for the period ending October 15 and for the period ending January 31:

<u>Container</u>	<u>Index</u>	
	<u>Oct. 15</u>	<u>Jan. 31</u>
Fish Ponds	2.7	0.7
Catch Basins	2.2	0.6
Cesspools	--	2.2
Ditches, Ground Pools	3.2	2.8
Drinking Troughs or Pans	.5	0.1
Barrels, Tanks, Tubs	1.0	0.9
Jars, Urns, Buckets, Pails	2.2	0.8
Tin Cans, Pans	1.8	0.6
Tires	2.3	1.7

<u>Container</u>	<u>Index</u>	
	<u>Oct. 15</u>	<u>Jan. 31</u>
Bottles	.6	0.2
Ape Plants	1.3	0.2
Lily Plants	4.2	0.4
Ant Cups	4.9	1.2
Flower Vases	4.7	0.8
Vine Bowls	6.5	1.9
Others	2.1	1.6

A study of the type indexes over the entire period of the control program indicates that reductions have been made in mosquito breeding in practically every kind of breeder. At the present time, although the indexes are rather low, the group comprised of tin cans and pans and the group comprised of all kinds of bottles, are still the most numerous breeders throughout the city. At the beginning of the enlarged program in September lily plants and ape plants were also included in this category. However, both of these latter types of breeders have responded quite satisfactorily to control. We have recommended removing them, cutting holes to drain them or have treated them with paris green or phenothiazine (see pictures included in this report).

Initially less than 15 percent of all of the breeding places were in vine bowls and flower vases which are considered interior breeders and in ant cups which are also usually found indoors. However, due to the comparatively faster elimination of outdoor breeding places, indoor breeders now comprise about 20 percent of the total.

By way of explanation, the Aedes breeding found in cess-pools is not in those which are in use but rather abandoned cesspools which have collected run-off and storm water. The Aedes breeding indicated as having been found in ditches and ground pools is generally that actually occurring in tin cans, bottles and other receptacles accumulated in ditches and other low areas. However, to date the inspectors have found three instances of Aedes albopictus breeding in "true" ground pools. All of these have been small pools located beneath buildings. This can probably be explained by the presence of gravid females which, though preferring water contained in receptacles, deposited their eggs in the only available water.

Beverage bottles, though having small necks, are found to be heavy breeders in Honolulu. Among the unusual types of breeders which have been found are coconut shells and coconut fronds (on the ground). Bomb shelters have been found



breeding both Culex and Aedes mosquitoes and also appear to furnish excellent mosquito harborage. With increased rainfall, rock and tree holes which were formerly dry have made their appearance as regular breeders. Permanent correction of these places is being accomplished by filling with neat cement. No breeding has been observed in leaves of banana trees, though occasionally a hollow banana stump has been found to contain larvae.

## V. Personnel

### A. Total Personnel

As of February 15 the following personnel were on duty on the Honolulu and Wahiawa programs:

	<u>Field Duty</u>	<u>Total</u>
Army	99	99
Chamber of Commerce	15	16
U. S. Public Health Service	<u>39</u>	<u>48</u>
TOTALS	153	163

Temporarily assigned to duty for Aedes control in other Oahu communities are the two colored Medical Sanitary companies. At present there are approximately 91 men, including the officers, assigned to inspection work, and approximately 40 assigned to clean-up activities.

The companies are now on practically a self-sufficient basis under the supervision of the officer personnel. Statistical clerks have been trained to handle the necessary compilation and computation of reports and indexes.

## VI. Public Education

### A. News Releases

During the period 11 news releases appeared in the local English newspapers and 7 in the foreign language newspapers.

### B. Talks

Talks concerning dengue control were given at the Kamehameha Preparatory School, Fern School PTA and Wahiawa-Waiialua Rotary Club.

VII. Wahiawa Program

Summary

Number of premises inspected	1353
Number of premises found breeding Aedes	41
Aedes breeding index	3.0%
Number of premises found breeding Culex	4
Culex breeding index	0.2%
Number of inspections per man-day (7 hour day)	36.6

The Wahiawa citywide index (3.0%) shows a further decrease from the previous period.

Arrangements were completed for the continued support of Aedes control at Wahiawa through funds collected by a special committee of the Wahiawa Community Association. All business firms are being assessed \$5.00 per month for this purpose.

Arrangements were also made whereby the group of high school boys under a local supervisor which has been doing inspection work will shift from this activity and instead place major emphasis on clean-up and similar work so that better supervision can be given to the boys.

Respectfully submitted,

/s/ Wesley E. Gilbertson  
Wesley E. Gilbertson  
P. A. Engineer (R)  
i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE CONTROL

TERRITORIAL BOARD OF HEALTH  
HONOLULU, T. H.

TENTH SEMI-MONTHLY NARRATIVE REPORT  
Period Ending January 31, 1944

I. Epidemiology

A. Number and Extent of Cases

Up to January 31 a total of 1379\* cases of dengue were reported, 11 of which were reported during the last semi-monthly period. During the previous period 28 cases were reported, indicating a considerable drop during the last half of January. However, during the closing days of the month there appeared to be a slight increase in the number of cases occurring.

Every portion of the city was represented in the locations of the cases of the last semi-monthly period. It has been observed that occasionally a small focus develops, wherein two or three secondary cases occur in the same household as the initial source or in an adjoining household. Unfortunately, some of these small foci have been unreported until one or two weeks after the occurrence of the secondary cases. When this happens it is not unlikely that enough mosquitoes become infected and disseminated to prolong the infection in that neighborhood.

II. Special Crews

A. Trouble Shooting Crew

During the period 186 premises were sprayed with insecticide in the follow-up of dengue cases. Of these, 25 were business establishments, 2 were large institutions, and 3 were rooming houses.

Two hundred seventy-five storm drains were checked, of which 72 were breeding. One hundred twenty-one storm drains were oiled.

\* The total number of cases reported up to Jan. 15, 1944 should have been 1368 instead of 1388 as printed in the last report.

#### B. Roof Gutter Crew

Eighty-eight premises with faulty roof gutters were permanently corrected, and the occupants of 79 additional premises were requested to remedy faulty gutters.

The downtown area and the areas in the vicinity of the formerly restricted Buckle Lane-River Street district have been completely checked by the roof gutter crew. At the present time they are working in the Kakaako area.

#### C. Clean-Up Crew

The clean-up crew picked up and hauled away 359 loads of bottles, cans and other debris during the period. Utilization of a new dumping area which is nearer to the areas being cleaned, resulted in a substantial increase in the amount of material moved.

#### D. Fish Stocking

Top feeding mosquito minnows were introduced into two swamp areas and two fish ponds which were found to be breeding mosquitoes.

### III. Inspection and Indexes

#### Summary

No. of premises inspected	45,994
No. of premises found breeding Aedes	499
Aedes breeding index	1.0%
No. of premises found breeding Culex	130
Culex breeding index	0.2%
No. of inspections per man-day (7 hour day)	49.0

Despite the heavy training load imposed upon the field forces (see Sec. VIII) the Aedes breeding index was further reduced and was 0.2% less than at the close of the previous period. Low rainfall conditions have greatly aided mosquito control activities.

For the first time since the program started no zone had had an index above 5.0%, nine zones or 12% had indexes above 3.0%.

Following is a summary by district of zone indexes which were reduced, increased and unchanged:



<u>District</u>	<u>Zone Indexes</u> <u>Up</u>	<u>Zone Indexes</u> <u>Down</u>	<u>Zone Indexes</u> <u>Unchanged</u>
Central	14	12	2
Kapahulu	8	11	5
Lanakila	<u>7</u>	<u>14</u>	<u>4</u>
Totals	29	37	11

#### IV. Personnel

##### A. Total Personnel

As of January 31 the following personnel were on duty:

	<u>Field Duty</u>	<u>Total</u>
Army	95	95
Chamber of Commerce	16	17
U. S. Public Health Service	<u>39</u>	<u>48</u>
Totals	150	160

During the period 5 employees were added to the Public Health Service payroll and one was separated.

#### V. Public Education

##### A. News Releases

During the period 14 news releases appeared in the local English papers and 7 in the foreign language newspapers.

#### VI. Wahiawa Program

##### Summary

No. of premises inspected	1772
No. of premises found breeding Aedes	61
Aedes breeding index	3.4%
No. of premises breeding Culex	4
Culex breeding index	0.2%
No. of inspections per man-day	53.7

The Wahiawa citywide index (3.4%) shows a decrease of 1.5% under the previous period. Three additional inspectors were assigned to Wahiawa for approximately 10 days in order to stop the increase in mosquito breeding which had previously occurred.

VII. Surveys of Islands of Kauai and Maui

Two 7-man soldier inspector survey crews trained on the Honolulu program were brought to Kauai and Maui respectively during the period to make surveys of Aedes breeding in communities which are congregating areas for military personnel. Preliminary indications are that Kauai indexes will be just as high as those found on Oahu, but the Maui indexes will probably be rather low.

VIII. Expansion of Aedes Control; Training of Necessary Personnel

Because of the position of this Territory as a military rest and replacement center and the dangers of immediate and continuous reintroduction of dengue fever, expansion of Aedes control to all Islands in the group is urgent.

During the period two colored Medical Sanitary Companies (228 men) were assigned for general orientation in mosquito control activities and for training in Aedes control. Each company was given one week of preliminary class work, followed by a week of concentrated instruction in differentiation of species, control methods and regular field activity.

The trainees were rated daily on their field work, and at the end of the period, on their class work. Potential inspectors are being selected from those who showed satisfactory knowledge in both phases at the end of the period. The remaining personnel will be divided into clean-up crews.

After a tempering period doing actual control work in Oahu communities, the two companies will be divided among the islands of Oahu, Hawaii, Maui and Kauai. Necessary officer personnel for supervision has been requested. All personnel will be assigned to the U. S. Public Health Service and reassigned to the Territorial Board of Health under which the Aedes control program will operate.

Experienced Aedes control foremen from the Honolulu program are being detailed with the newly formed inspection crews for supervision during the initial period of operations.

Respectfully submitted,

/s/Wesley E. Gilbertson  
Wesley E. Gilbertson  
P. A. Engineer (R)  
i/c Dengue Mosquito Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE CONTROL  
TERRITORIAL BOARD OF HEALTH  
HONOLULU, T. H.

NINTH SEMI-MONTHLY NARRATIVE REPORT  
Period Ending January 15, 1944

I. Epidemiology

A. Number and Extent of Cases

Up to January 15 a total of 1388 cases of dengue were reported, 28 of which were reported during the last semi-monthly period. The latter figure represents a drop of 17 cases from the previous period.

The cases were scattered throughout the entire city of Honolulu. All previous foci of infection were quiet and no new foci developed.

The relatively long incubation of the disease and the lag in reporting some of the cases considerably complicates epidemiological analysis. Often it is necessary to attempt to construct the epidemiological picture by questioning the dengue patient concerning his activities over a period ranging from 10 days to 20 days prior to the day of questioning. Obviously, some incomplete and inaccurate information results due to the patient not being able to remember every detail of his movements after that lapse of time.

II. Spraying Activities

A. Special Work

In an effort to kill all adult infected mosquitoes and stamp out the last few cases, if possible, spraying measures have been instituted at every place where dengue might have been contracted or where cases were visited while in the infectious stage. During the current period the OCD portable power sprayer was utilized for spraying a four-block area in Kakaako district, three downtown markets, and the USED camouflage factory in Kalihi.

Since the heart of the downtown area had been frequented by a number of dengue patients while in the prodromal

infectious period, daily spraying by business firms was considered to be of some prophylactic value. A total of 534 business firms were contacted the first week of January, with a request to spray the interiors of their establishments each day for a period of two weeks. About one-third of the firms were found not to have adequate spraying facilities, but the remainder agreed to comply with the request.

#### B. Regular Work

On the follow-up of dengue cases, 120 residences, 7 apartment buildings and rooming houses, 16 offices, and 15 other business establishments were sprayed with insecticide. Trips were made to Ewa, Wahiawa and Pearl City to follow up cases in these communities. The entire plant at Children's Hospital was sprayed and one of the wards of Queen's Hospital also received the same treatment.

Recently a new use of the sure-shot sprayers has been developed. By removing the spraying nozzle and using the nozzle extension pipe only a powerful spray is produced which can be used to spray underneath houses, in out-buildings and other exterior areas. Methyl Chloride gas is used as a pressure agent. This use is considered very important because there is undoubtedly a period of ten days or more between the time when the patient received his infection and when the spraying crew arrives (due to the dengue incubation period and lag in reporting) and mosquitoes would be able to disseminate to surrounding areas, whether the home is screened or not. It has been difficult to spray satisfactorily these areas, except with power sprayers which are unhandy for short, scattered spray jobs. Therefore the new use of the sure-shot sprayers solves a pressing problem.

#### C. Storm Drains and Catch Basins

##### Summary

Storm drains checked	182
" " oiled	124
" " breeding	19
Water, gas, electric, and telephone manholes checked	155
" oiled	40

Arrangements were made to spray catch basins in the military restricted area along the Honolulu waterfront.



### III. Inspections and Indexes

#### Summary

No. of premises inspected	38,639
No. of premises found breeding Aedes	489
Aedes breeding index	1.2%
No. of premises found breeding Culex	110
Culex breeding index	0.2%
No. of inspections per man-day (7 hour day)	46.9

The citywide Aedes breeding index for the period (1.2%) is the same as for the previous period. It appears, therefore, that the increase in mosquito breeding which occurred during the month of December has been slowed up.

Following is a summary by districts of the number of zones which had increases, decreases and the same indexes during the current period, compared with the previous period:

	<u>Zone Indexes</u> <u>Up</u>	<u>Zone Indexes</u> <u>Down</u>	<u>Zone Indexes</u> <u>No Change</u>
Central district	9	16	3
Kapahulu "	8	11	5
Lanakila "	<u>10</u>	<u>11</u>	<u>4</u>
Totals	27	38	12

A complete inspection of the Royal Hawaiian Hotel buildings and yard (Navy restricted area) was made during the period. No breeding was found but recommendations were given for correction of a number of potential breeding places.

Special inspections were made of seven bottle yards in Honolulu owned by beverage and junk companies. Considerable progress was noted since the last special inspection about one month ago. As a result of correction activities by these firms, no serious breeding conditions have been found in the bottle yards.

During the past two months a number of Board of Health orders have been issued for abatement of mosquito breeding conditions where inspections have indicated that there was chronic violation of the regulations. Compliance has resulted in every case.

### IV. Special Activities

#### A. Roof Gutter Crew

During the period the 2-man roof gutter crew accomplished the following:

Roof gutters cleaned	52
" " removed	13

#### B. Fish Stocking

Four ponds and swamp areas were stocked with mosquito fish during the period.

#### C. Clean-Up Crew

The clean-up crew picked up and hauled away 160 loads of miscellaneous receptacles during the period. Fifty-eight loads of debris previously unreported bring the total number of loads disposed of by the clean-up crew to date to 1,161.

### V. Public Education

#### A. News Releases

During the period 22 news releases appeared in the local English newspapers.

#### B. Stuffers

Ten thousand stuffers were released during the period through cooperation with a locallaundry. The electric company bills for the past month contained 30,000 stuffers on dengue mosquito control.

#### C. Other Publications

The Hawaii Farm and Home magazine carried an article on the Honolulu dengue epidemic and the responsibility of householders for mosquito control.

### VI. Surveys of Rural Oahu Communities Completed

Completing the list of Oahu communities outside of Honolulu which have been surveyed for Aedes breeding, the following summary is presented:

<u>Location</u>	<u>Aedes Breeding Index</u>	<u>Percent Containers Wet but not Breeding</u>
Aiea	11.1	24.6
Ewa	3.6	25.4
Kawailoa	4.0	38.9
Pearl City	5.2	23.1
Waianae	3.4	20.2



## VII. Personnel

### A. Total Personnel

As of January 15 the following personnel were on duty:

	<u>Field Duty</u>	<u>Total</u>
Army	95	95
Chamber of Commerce	19	20
U. S. Public Health Service	<u>36</u>	<u>44</u>
Total	150	159

During the period 7 employees were separated from the Public Health Service payroll.

Seventeen new soldier inspectors reported during the period, 8 as replacements and 9 to cover zones previously covered by civilian inspectors.

### B. Chamber of Commerce Personnel

As of December 31, 1943 the fund of approximately \$23,000 established by the Public Health Committee of the Chamber of Commerce for dengue epidemic control was practically exhausted. A new six-month budget of \$5338.50 was presented to the Public Health Committee and passed by that group. Of this amount approximately \$1900 was set up for payrolls for one month for the special mosquito control staff which was employed through Chamber of Commerce funds at the beginning of the epidemic in August, 1943. Arrangements are being made to take over on the Public Health Service payroll these employees on or before February 1, 1944. An additional \$1950 was earmarked for salary expenditures for new recruits which are being initially employed through Chamber of Commerce funds pending investigation by the Federal Civil Service and appointment on the Public Health Service payroll. Approximately \$1400 was placed in the budget for maintenance of certain automotive vehicles in use on the dengue control work and for printing and other necessary items.

At the request of the Board of Health, due to an increase of typhus here, arrangements are being made to return as soon as possible to rodent control activities, some members of the Chamber of Commerce Rat and Mosquito Control Squad who had been assigned exclusively to the dengue program since August of last year. All of these trained individuals have been in supervisory positions and replacement on the dengue control staff is therefore quite difficult. The first man was released on December 1, 1943, two more on January 15, 1944, and two men will be released at the end of January.

# VIII. Public Health Service Expenditures

Expenditures incurred by the U. S. Public Health Service for dengue control for the period of September 1 to December 31, 1943 are as follows:

<u>Month</u>	<u>Salaries</u>	<u>Supplies and Equip.</u>
September	\$2272.84	\$3566.66
October	7165.31	547.86
November	9411.98	899.25
December	8585.77	542.65
Final payrolls	416.47	
	<hr/>	<hr/>
Totals	\$27852.37	\$5556.42
Grand Total	<u>\$33,308.79</u>	

# IX. Wahiawa Program

## Summary

No. of premises inspected	1059
No. of premises found breeding Aedes	52
Aedes breeding index	4.9%
No. of premises breeding Culex	5
Culex breeding index	0.4%
No. of inspections per man-day (7 hour day)	34.1

The Wahiawa citywide index (4.9%) shows an increase of 1.1% over the previous period. This reflects, as did the Honolulu indexes during the previous month, an increase in rainfall. Additional inspectorial manpower will be assigned to the Wahiawa program for a short period in an effort to reduce mosquito breeding in the higher zones.

# X. Progress Report on Entomological Studies

## A. Distribution

Studies on the distribution of Aedes albopictus and Aedes aegypti on the island of Oahu and particularly in the city of Honolulu are being continued. On the basis of present figures (subject to revision) it is observed that the Aedes aegypti is restricted to the leeward side of the island, while Aedes albopictus is widely distributed. Within the city of Honolulu, Aedes aegypti is restricted to zones which are in the lower areas along the sea and particularly in the more densely populated zones. The



data on distribution is being continued with special emphasis on obtaining a significant number of samples from every zone.

B. Longevity

Cage studies on the duration of life of the adults of Aedes albopictus have indicated that they will live for periods of at least two months, at room temperature (67-72°F). The males were fed on moist raisins or honey water and the females were fed on human blood. Laboratory tests of the duration of life of female Aedes albopictus which had been fed on a dengue patient during the infectious stage were inconclusive, due to the small numbers of mosquitoes used. However, one of the infected mosquitoes lived for four days longer than the non-infected controls and none of these mosquitoes lived longer than 16 days.

C. Flight Range

The flight range experiment is continuing. Difficulty has been experienced in recapturing after release of stained specimens. Tests are being conducted on various types of traps suitable for the Aedes mosquito.

D. Filariasis Transmission

A study of the transmission of Filariasis by the mosquitoes of Hawaii is underway. A study of the local population of Samoans is being made in order to discover a good carrier of microfilaria. Mosquito colonies and experimental cages are being prepared for this work.

Respectfully submitted,

/s/Wesley E. Gilbertson  
P. A. Sanitary Engineer (R)  
i/o Dengue Control





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE CONTROL  
TERRITORIAL BOARD OF HEALTH  
HONOLULU, T. H.

EIGHTH SEMI-MONTHLY NARRATIVE REPORT  
Period Ending December 31, 1943

I. Epidemiology

A. Number and Extent of Cases

During the last semi-monthly period 45 cases of dengue were reported, bringing the total reported to December 31 to 1,340 cases. Five cases previously included in the total have been dropped because the final diagnosis was not dengue.

The epidemiological picture has changed considerably during the past two months. The number of cases had dropped off markedly so that individual case histories can be better studied. They must be relied on to a greater extent than previously because it is difficult to make satisfactory statistical epidemiological studies from week to week.

It is particularly significant that no large foci of infection continue to exist. The recent cases have been scattered over most of the city, with the central portion showing the highest concentration.

There is included with this report a chart showing the progress of the epidemic to the end of the year. The rise and fall of the cases in the three areas (Waikiki, Kakaako, and Buckle Lane-River St.) which were foci of infection are also shown. These cases are allocated by residence.

At the present time work is in progress to complete the epidemiological picture by allocating the scattered cases to place of probable contact. Symptomological statistics are also being worked up.

Military authorities lifted all dengue restrictions for service personnel on December 30.

At the beginning of the period a study was made to locate areas which have been the site of sporadic cases reported during the past month, or, where possible, to locate sources of infection for cases living elsewhere. A total of 17 such areas were delineated, ranging in size from a single residence with the surrounding half dozen houses to a 4 square block area in the Kakaako district.

## II. Spraying Activities

### A. Special Work

An Army decontamination truck was utilized for one full week, spraying the exteriors of all premises included in the above described list of 17 special focal areas. At the same time a crew of six men equipped with hand sprayers sprayed the interiors of all homes and business establishments. Pyrethrum base spray with water as a diluent and added emulsifier was used for the exterior spray. A total of approximately 1900 gallons were used. In the hand sprayers pyrethrum extract diluted with kerosene was used for interior spraying.

### B. Regular Work

The trouble shooting squad, in regular follow-up of dengue cases, sprayed 170 homes, 11 apartments and tenement rooms, 7 warehouses, and 2 business places.

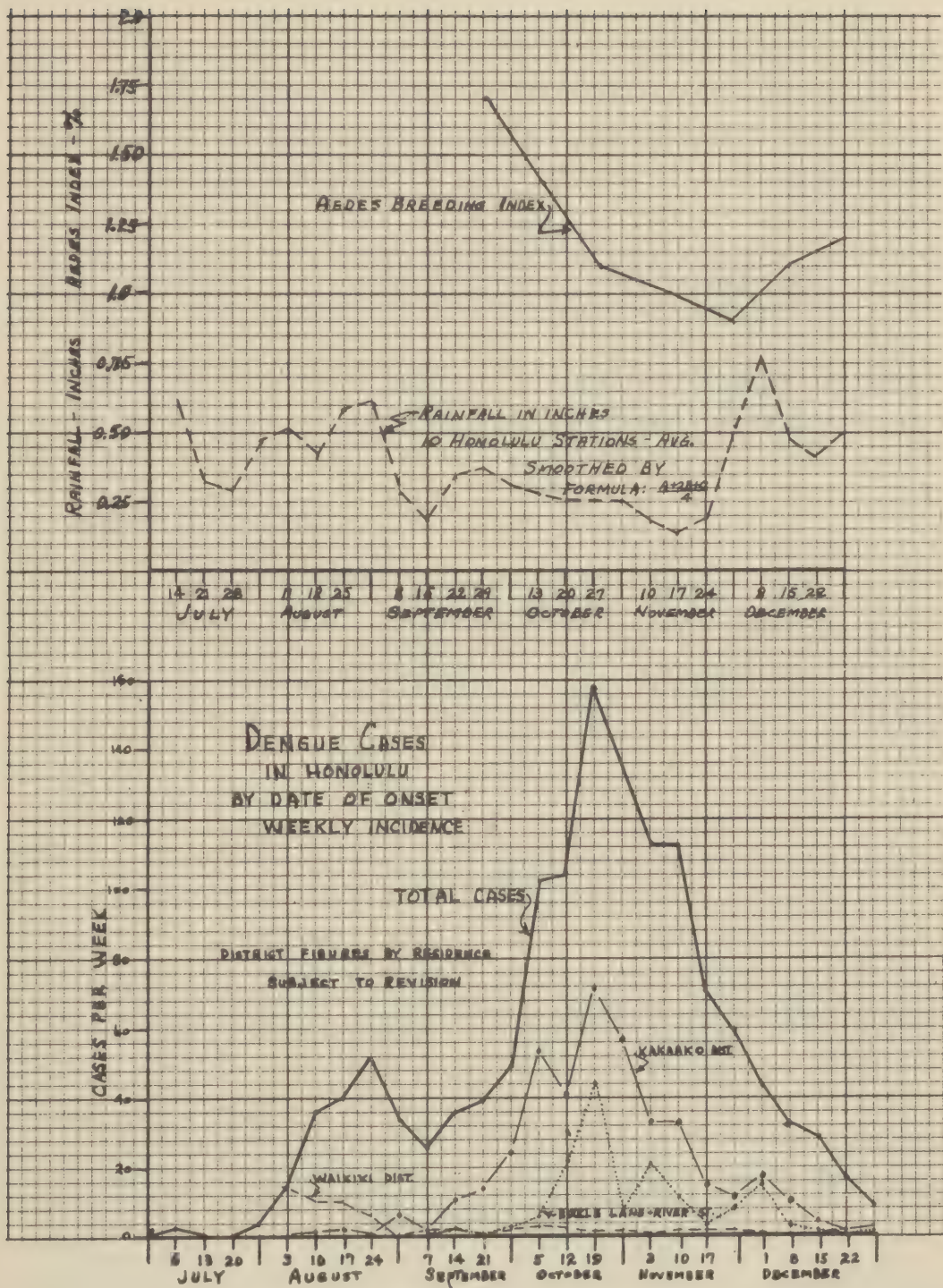
### C. Motorcycle Spraying Unit for Catch Basins

A catch basin spraying unit was put into use during the last days of the period. It consists of a three-wheeled motorcycle equipped with a pressure tank, hose, and spray gun. The vehicle, which was formerly owned by the Shriners' Hospital, had been in use by the Office of Civilian Defense and was turned over to the mosquito control program by the latter organization. The Public Health Committee of the Chamber of Commerce furnished funds for preparing the machine and properly equipping it for the work.

There has been an increase in the rainfall during the past four weeks, accompanied by an increase in mosquito breeding in catch basins. These generally breed Culex mosquitoes but Aedes have been found a number of times. Of 90 catch basins checked, 57 contained water and required oiling and 15 were breeding.

Water, gas, telephone and electric company manholes are also being checked, oiled if necessary, and the proper officials notified if found containing water.









### III. Inspections and Indexes

#### Summary

No. premises inspected	43,173
No. premises found breeding Aedes	519
Aedes breeding Index	1.2%
No. premises found breeding Culex	76
Culex breeding Index	.2%
No. Inspections per man-day	52.4

The citywide Aedes breeding index for the period (1.2%) is 0.1% higher than the previous period and 0.3% higher than the lowest index, which occurred during the last half of November.

Five zones or 7% had indexes above 5%; 9 zones or 12% had indexes above 3%; and in 9 zones or 12% no Aedes breeding was found. In 41 of the 77 zones there was an increase in mosquito breeding.

### IV. Special Activities

#### A. Roof Gutter Crew

The activities of the 2-man roof gutter crew were concentrated in the congested area of Honolulu, and covered an area of approximately 25 square blocks during the period. One hundred gutters were checked and 46 received permanent correction.

#### B. Fish Stocking

Ten ornamental back yard fish ponds were stocked with top-feeding minnows during the period.

#### C. Clean-Up Crew

The clean-up crew picked up and hauled away 226 loads of miscellaneous containers from 46 locations during the period.

### V. Public Education

During the period there were 14 news releases in English newspapers and 10 in foreign language publications.

Three hundred posters, printed through Chamber of Commerce Health Committee funds, are being distributed to public places throughout the city by Boy Scouts.

Attached to this report is a copy of the new householders bulletin with four foreign language translations (Filipino, Korean, Chinese and Japanese) on the reverse side, and a copy of the Traveller's Edition of the Hawaii Health Messenger.

## VI. Surveys of Rural Oahu Communities

Utilizing military personnel from the Honolulu control program, Aedes breeding surveys of 8 war-connected communities in rural Oahu were completed during the period. Following is a summary of the results thus far:

<u>Location</u>	<u>Aedes</u> <u>Breeding Index</u>	<u>Percent Containers</u> <u>Wet but not Breeding</u>
Lanikai	4.0	42
Waialua	6.1	39.4
Haleiwa	7.1	35.8
Kahuku	7.3	42.4
Waipahu	9.2	32
Waimanalo	10.5	37
Kailua	18.3	29.9
Kaneohe	21.7	57

The Public Health Committee of the Chamber of Commerce furnished funds for noon-day meals for inspectors on survey duty in rural Oahu.

## VII. Personnel

### A. Total Personnel

As of December 31 the following personnel were on duty:

	<u>Field duty</u>	<u>Total</u>
Army	86	86
Chamber of Commerce	19	20
U. S. Public Health Service	43	52
Totals	<u>148</u>	<u>158</u>

During the period three employees were separated from the Public Health Service payroll.

### B. Absenteeism

The problem of absenteeism among civilian personnel has been difficult to cope with. Initially, it was hoped that by appealing to the men most unnecessary absences would be eliminated. However, recently it has been shown that disciplinary action is necessary.



Police have been called in to investigate certain chronic absentees under the military law. Further, this office has adopted the policy of giving disciplinary leave without pay in all cases of unauthorized absence. During the current period such action was taken on 23 of the 46 field employees.

#### VIII. More Dengue on Kauai

Another case of dengue was reported from the island of Kauai in the Eleele Camp, which adjoins the Port Allen Camp where the previous cases occurred. The onset of this case was December 21. There was also another suspected case in the same household with onset on December 11. The latter person had been in Honolulu during the last week of November. More information has been requested in an effort to establish the probable point of contact. To date there have been reported three confirmed cases and two suspected cases of dengue on Kauai. Vigorous exterior and interior spraying, accompanied by inspection-correction activity, were instituted again immediately after the additional cases in Eleele Camp were reported.

#### IX. Wahiawa Program

##### Summary

No. Premises inspected	1524
No. Premises found breeding Aedes	58
Aedes breeding Index	3.8%
No. Premises found breeding Culex	5
Culex breeding Index	0.3%
No. inspections per man-day	54.4

The Wahiawa citywide index (3.8%) for the current period is reduced to less than half of the index found during the survey. The inspectors report excellent cooperation from most of the householders.

Through funds provided by the Wahiawa Community Association, householder bulletins similar to the one attached to this report have been provided for distribution to local citizens.

Through the efforts of the military foreman in charge of the Wahiawa inspection forces, a number of dumps which were sources of mosquito breeding have been removed.

Respectfully submitted,

/s/ Wesley E. Gilbertson  
Wesley E. Gilbertson  
P. A. Sanitary Engineer (R)  
i/c Dengue Control





saved. Once Dengue gains a foothold, it is hard and costly to control. Your cooperation can be of great help now, during these critical War days. Remember that although you may feel perfectly well now, it takes the disease 3 to 15 days to incubate in your body before symptoms are noticeable. At the first sign of ill-health get in touch with your Doctor or the Board of Health at your destination.



**BE ON GUARD—KEEP**

**Dengue** FROM SPREADING FURTHER!  
**MALNUTRITION DIVISION, S.O.U.**

# WARNING

THE CITY OF HONOLULU is now suffering from an epidemic of DENGUE FEVER. You may have been bitten ALREADY by the MOSQUITO which spreads DENGUE and not be aware of your infection.

Preventing the spread of DENGUE FEVER from Oahu to the other Islands is of extreme importance. Upon arrival at your destination do not

★ *Special Travelers Edition*

THE

## Hawaii Health Messenger

PUBLISHED BY THE TERRITORIAL BOARD OF HEALTH

Honolulu, T. H.

December, 1942



Courtesy of Life Magazine

YOU HAVE JUST LEFT A

**Dengue** FEVER AREA!

hesitate to call the Board of Health or your Doctor IMMEDIATELY if you experience any of the following symptoms:

*Aching Joints*  
*Fever*  
*Tired Feeling*  
*Severe Headache*

Do NOT go to your Doctor, have him come to you. Go to bed in a screened room, under a mosquito net if possible. DENGUE is infectious during the first four days of the disease. If your case is diagnosed as Dengue, stay under a bed net until the infectious stage of the disease has passed. DON'T TAKE ANY CHANCES!

If Dengue Fever can be confined to Honolulu, a great amount of vital time and money will be







***The spread of***  
**DENGUE FEVER**  
***must be stopped!***

Everyone can and must help to eliminate the day mosquito. Don't let your home or yard serve as a breeding place for mosquitoes.

- 1** Remove all old tires, tin cans, bottles, etc.
- 2** Puncture and drain the water cups of lily plants.
- 3** Cut off aye plants at ground level.
- 4** Treat all NECESSARY water containers with kerosene once a week.
- 5** Root ivy vines and other water plants in earth or sand.

Follow these simple rules: It is YOUR responsibility to prevent mosquito breeding on your OWN premises.

PREPARED BY THE PUBLIC HEALTH COMMITTEE OF THE  
CHAMBER OF COMMERCE OF HONOLULU

Aldaw a panagiwaras ti lamok ti Dengue a' Gurigor. Reb-beng mo nga aramiden dagitoy sumaganad a nalaka nga pamusposan tapno maatipa dagiti lamok nga agrway dita inalan yon:

1. Ibel-leng mo wenno paklebem amin a di nakassasapol a pagikkan danom.
2. Ipunget mo nga pukanen dagiti aglungsot a mula.
3. Pabaroem a kanayon ti danom tay macetas mo a lily.

모기가 덴기열병  
을 전파한다 집 근처  
에서 모기가 식기 치  
는 것을 예방하는 수  
운 방법이 이와 같다  
一 불필요한 그릇들  
을 치울 것  
二 정원에 모기 치는  
나무들을 베일 것  
三 화분에 물피이는  
것을 빌 것

蚊(やぶか)はデング熱(ねつ)の媒介者(ばいかいしゃ)です。左記(さきき)の如(ごと)く簡單(かんたん)な注意(ちゅうい)で屋敷内(やしきない)に蚊(か)の發生(はつせい)するのを妨(ふせ)ぐ事は各自(かくじ)の務(つと)めです。

一、不必要(ふいっえう)な溜(たま)り水(みづ)は總(すべ)て除(のぞ)く事(こと)

一、アペ(タロ葉類(はるい))は根元(ねもと)より切(き)り取(と)る事(こと)

一、百合類(ゆりるい)の溜(たま)り水(みづ)を除(のぞ)く事(こと)

日間蚊傳骨痛症。你的責任就是依從以下的普通規例。就可免蚊在你的地方繁殖。

(一) 移去或空虛無用的水罐。

(二) 斬去偽芋樹。

(三) 排去百合花杯中的水。



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE CONTROL  
TERRITORIAL BOARD OF HEALTH  
HONOLULU, T. H.

SEVENTH SEMI-MONTHLY NARRATIVE REPORT  
Period Ending December 15, 1943

I. Epidemiology

A. Number and Extent of Cases

A total of 1,300 cases of dengue were reported up to December 15. During the last semi-monthly period the total was 98 cases. This averages 6.5 cases per day, in comparison with 8.8 cases per day, 15.4 cases per day, and 21.3 cases per day for the preceeding semi-monthly periods in reverse chronological order to the highest semi-monthly period.

During the first week of December there was a slight increase in the number of cases reported from the Buckle Lane-River Street area. This rise did not continue. All other previous foci of infection continued to decrease.

Vigorous daily spraying measures instituted some weeks ago in certain public schools from which a number of cases had been reported among school children has resulted in a considerable decrease in new cases reported from this age group.

Dengue has now been contracted by a total of 3 of the dengue control personnel. One was a foreman and the other two were inspectors--one civilian and one soldier.

II. Spraying Activities

No large scale wholesale spraying work was undertaken during the current period. However, analyses of epidemiological data revealed that the 100--200 block district on Kukui Street in the Buckle Lane-River Street area was the probable source of a number of cases, and the interiors of all residences and business establishments, although they had been previously sprayed in connection with the regular follow-up of cases, were re-sprayed as an additional factor of safety.

The trouble shooting crew, which follows up the cases, sprayed during the period: 157 residences, 282 tenement rooms, 17 apartments, 8 warehouses, and 66 business establishments. In addition, this crew checked 264 storm drains and oiled 127 storm drains, 35 of which were found breeding. The recent increase in rainfall has resulted in storm drains becoming greater hazards.

### III. Inspections and Indexes

#### Summary

No. premises inspected	42,274
No. premises found breeding <i>Aedes</i>	480
<i>Aedes</i> breeding Index	1.1%
No. premises found breeding <i>Culex</i>	62
<i>Culex</i> breeding Index	0.1%
No. inspections per man-day	50.6

The citywide *Aedes* breeding index (1.1%) has raised 0.2% since the last semi-monthly period, reflecting increased rainfall over the entire city. Thirty-seven zones had higher indexes this period than last period, and the remaining forty were the same or lower. The zones where increased mosquito breeding was found are scattered throughout the city.

Eight zones or 10% had indexes above 3%, and three zones or 4% had indexes above 5%.

The military dengue-restricted areas had the following indexes:

<u>Zones</u>	<u>Area</u>	
8B, 9B	Buckle Lane-River St.	0.5%, 0.0%
2A, 4, 5A, 5B	Kapalama-Kalihi-kai	4.5%, 1.0%, 0.2%, 0.7%
14A, 14B	Kakaako	2.2%, 0.0%

These indexes are slightly higher than corresponding indexes for the previous period.

Each of the three district offices is starting a "mother foci" and "chronic breeder" map. The total number of premises with *Aedes* breeding in the city now has been reduced to the point that troublesome places may receive individual attention. When a small neighborhood shows repeated breeding in miscellaneous containers, this fact may be taken to indicate that there is an undiscovered "mother" or generating focus in the area. A special thorough search may result in locating a hidden breeding place.



The "chronic breeder" maps will also aid in pointing out premises which call for Board of Health police power to abatement of the mosquito breeding hazard.

#### IV. Special Activities

##### A. Clean-up Squad

During the period the special clean-up squad with an average of 23 men and 4 trucks collected and disposed of 218 loads of containers consisting mostly of tin cans and bottles.

As a result of conferences and field trips throughout the city with the engineer of the Bishop Estate, this group has agreed to employ a crew of men to clean up premises and lots under their control and place the accumulated piles of containers and debris in places which are accessible to the dengue control clean-up trucks. After this work has been completed, the Bishop Estate is placing the responsibility for maintenance of satisfactory conditions upon the tenants.

Arrangements were made with the Hawaii Housing Authority for a complete clean-up of the slum area located along Vineyard Street. This area adjoins the Buckle Lane district, and the timely action probably helped to prevent a localized outbreak in another slum district.

##### B. Roof and Gutter Squad

Two inspectors were assigned on December 10 to inspection and elimination of roof and gutter breeding places in the Honolulu business district. Initial reports indicate that the recent heavy rainfall filled many clogged gutters, and mosquito breeding had already commenced. In addition to the numerous gutters cleaned and drained, 15 gutters were permanently eliminated as mosquito breeding places.

#### V. Personnel

##### A. Total personnel

As of December 15 the following personnel were on duty:

	<u>Field duty</u>	<u>Total</u>
Army	66	66
Chamber of Commerce	23	24
U. S. P. H. S.	46	55
Totals	<u>135</u>	<u>145</u>

During the period three employees were separated from the Public Health Service payroll.

- B. Since September 1 a total of 105 applicants (foremen and inspectors) have been referred to this office by Civil Service. Of these, 79 were suitable for appointment, 33 of which were later separated, leaving the present total of 46 Public Health Service employees on field duty.

## VI. Public Education

### A. News Releases

During the period a total of 11 newspaper releases appeared in the local newspapers. Through the Governor's "Work to Win" Committee, the Governor, Chairman of the War Manpower Commission, and leading businessmen have issued published statements urging public cooperation with measures for control of *Aedes* mosquito breeding.

### B. Visual Education

A photographer from the "Work to Win" Committee took a number of photographs to be utilized with publicity campaigns. The same committee also prepared an excellent exhibit utilizing the theme: "Dengue Steals Vital Man-hours From the War Effort."

### C. Travelers Bulletin

At the request of the Board of Health, a special pamphlet has been prepared for distribution to all inter-island air and surface travelers concerning the importance of preventing dengue from spreading to the outside islands. A summary of the symptoms of dengue is included and emphasis placed on the necessity of calling a doctor upon the appearance of any suspicious symptoms.

### D. Stuffers Distributed

Through the cooperation of the Hawaiian Electric Company, 30,000 stuffers were distributed with the monthly electric bills. These contained instructions to each householder for the elimination of dengue mosquito breeding places.

## VII. Wahiawa Program

Final tabulations on the Wahiawa survey indicates an *Aedes* breeding index of 8.6%. This information was brought to the attention of the local government physician and the Wahiawa Community Association, pointing out that an explosive outbreak



could occur with the existence of such a high breeding index. The Community Association agreed to support a dengue mosquito control campaign and initially allocated a sum of \$500.00 for a period of three months. This fund is to be used for the continued employment of an experienced mosquito control foreman and a group of about a dozen high school boys to do mosquito control work on a one-day-a-week basis. In addition, a series of posters and pamphlets are being prepared for distribution to the householders of Wahiawa. Beginning Tuesday, December 7, three soldier inspectors and a foreman began regular house-to-house inspectorial service at Wahiawa.

#### VIII. Dengue on Kauai

A case of dengue was reported on the island of Kauai, Port Allen Camp, with onset date on October 30. The patient had been in Honolulu within the maximum incubation period of dengue. Immediate remedial measures taken by the Board of Health included isolation of the case, spraying of all houses and yards within a radius of 500 feet, and inspection of Port Allen Camp and two adjoining communities, Eleele and Hanapepe. Exterior spraying was done with commercial insecticide, utilizing Army Chemical Warfare high pressure sprayers. Two complete cycles of inspection by soldier inspectors were made, each followed by re-checking of premises where breeding was found.

A second case of suspected dengue appeared on November 26 at the office of the same doctor who diagnosed the first case, with what appeared to be the terminal rash of dengue. This patient lived about 600 feet from the first case. The history indicated none of the usual symptoms of dengue, except slight general malaise. This case was not reported as dengue until the appearance of the third case.

The third case with onset on December 6 was reported by the same physician as soon as seen by him--on December 7. This patient lives across the street from the first case. The area was again sprayed both inside and outside of houses, in some cases to a distance of 1,000 feet, on December 9. Re-inspection of the three communities was started. On December 14 the entire area was re-sprayed. Routine inspection has been established. Since December 10, every home in Port Allen Camp, Eleele, and Hanapepe has been visited by a Board of Health or O.C.D. nurse to locate other cases, if such occur. This will continue for two weeks. No new cases have been reported since December 7.

Radio, newspapers, and the O.C.D. organization have disseminated dengue mosquito control information to the general public

on Kauai in order to stimulate elimination of breeding places.

Respectfully submitted,

/s/ Wesley E. Gilbertson  
Wesley E. Gilbertson  
P. A. Sanitary Engineer (R)  
i/c Dengue Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE CONTROL  
TERRITORIAL BOARD OF HEALTH  
HONOLULU, T. H.

Sixth Semi-Monthly Narrative Report  
Period Ending November 30, 1943

I. Epidemiology

A. Number and Extent of Cases

Up to November 30 a total of 1,202 cases of dengue were reported. During the last semi-monthly period 132 cases were reported, in comparison with 231 cases during the period ending November 15, and 321 cases during the period ending October 31.

A study of the locations of these cases indicates that the Kakaako and Buckle Lane-River Street areas appear to be gradually showing the results of control. The Kalihi-kai or Kapalama area from which a few cases have been reported each week, appears to be gaining headway rather than dying out. If this continues, wholesale spraying measures will be instituted in the area.

B. Follow-Up of Cases

With fewer new cases of dengue being reported each week, a more complete epidemiological study of each individual case is being made by the epidemiologist and public health nurses. From these studies, much valuable information is being gained by which control operations are being guided. For instance, insecticide spraying is now being done at many places where it is suspected that the case might have been contracted, and also where the dengue victims visited during the infectious period.

II. Spraying Activities

On November 18 the portable gasoline driven sprayer was utilized for a complete spraying of the McKinley High School Buildings, bomb shelters, and nearby restaurants where students eat noon lunches. This action was taken because of the sudden appearance of a number of dengue cases among the students and teachers in the institution. Two business firms, Bunny Ranch (a sandwich factory) and Easy Appliance Company (electrical appliance firm) were also thoroughly sprayed after epidemiological studies indicated these places were possible sources of infection. For

the same reason, the Kewalo Theater located in the Kakaako area was sprayed, utilizing sure-shot hand sprayers. The Mary Knoll Convent, comprised of 10 buildings, also received a complete spray job.

### iii. Inspection and Indexes

#### Summary

Total inspection of premises. . . . .	.42,326
Number premises breeding <u>Aedes</u> . . . . .	420
Aedes breeding index. . . . .	0.9%
Number premises breeding <u>Culex</u> . . . . .	.55
Culex breeding index. . . . .	0.1%
Number of inspections per Man-day . . . .	.42.1

The current Aedes breeding index is 0.1% lower than the index for the previous period. Five zones or 7% had indexes above 3%, and one zone or 1.0% had an index above 5%. Twenty seven zones had higher indexes during the last period than previously, and thirty-seven were decreased. The highest zone (7.1%) was 11C, located in Nuuanu Valley, was also highest last period.

Two zones have been free of Aedes breeding for one month and in a third zone no breeding has been found for six weeks. On an average, two containers have been found per premise found breeding.

The military dengue-restricted areas had the following indexes:

<u>Zones</u>	<u>Area</u>	<u>Indexes</u>
8B, 9B	Buckle Lane-River St.	0.9%, 0.0%
2A, 4, 5A, 5B	Kapalama-Kalihi-Kai	0.0%, 1.0%, 0.0%, 0.0%
14A, 14B	Kakaako	1.0%, 0.0%

These areas are all significantly reduced from previous periods, reflecting the impact of concentrated control effort.

### iv. Special Activities

#### A. Clean-up Squad

During the period the special clean-up squad with an average of 24 men and 4 trucks, collected and disposed of 192 loads of containers, consisting mostly of tin cans and bottles.

#### B. Bottle Yards

Special inspections were made of 6 large bottle yards owned and operated by junk dealers and liquor bottlers. At all



of these yards there are tremendous accumulations of bottles of all types, many of which could collect water during rains and become mosquito breeding hazards. At each yard, however, the management has a crew of 1 to 5 persons sorting bottles and placing them in crates in an inverted or horizontal position. At one yard provision had been made for covering the bottles with a tarpaulin at night. In each case the management was contacted and emphasis placed on the necessity of completing the bottle sorting and crating activities before the advent of rainy weather.

## V. Personnel

### A. Total Personnel

As of November 30 the following personnel were on duty:

	<u>Field duty</u>	<u>Total</u>
Army	68	68
Chamber of Commerce	23	24
U. S. P. H. S.	<u>50</u>	<u>61</u>
Total	141	153

During the period 10 employees were separated from the Public Health Service payroll.

- B. The recruitment of new civilian personnel has been extremely slow during the month of November. In fact, during the last one-half month only two applicants were referred by Civil Service. A complicating Civil Service regulation recently instituted necessitates that all persons of Japanese ancestry must be subjected to investigation, requiring at least two weeks, prior to authority to make the appointment. Since approximately three-fourths of all applicants are of Japanese ancestry, it is obvious that this regulation introduces an inconvenient problem in the hiring of new personnel.

## VI. Public Education

### A. News Releases

During the period a total of 15 newspaper releases appeared in the local news papers.

### B. Visual Education

Movie Trailer--A two minute 35 mm. movie trailer made through the cooperation of the Army Signal Corps, Navy Photographic

Laboratory, Army Special Services Division, and the Chamber of Commerce was completed and copies distributed to the various theaters.

Initially, the trailer is being run in the "first run" houses and in theaters located in the most heavy dengue-stricken areas. Arrangements have been made to cover all theaters in Honolulu, other theaters located in rural Oahu, and later on the outside islands.

In addition, several theaters have shown slides on dengue prepared from material from this office. The Army Signal Corps provided a photographer for taking a series of 26 pictures depicting a typical day in the life of the soldier inspector on duty.

A large series of pictures were taken by the school photographer while the spraying of McKinley High School was in progress. These are to be utilized in the school paper and annual publication.

#### C. PTA Educational Program

A short talk and demonstration were given at a meeting of the Parent-Teacher Association Executive Committee. Arrangements were made to circularize the officials of each PTA local unit on Oahu and also the outside islands with a pamphlet regarding the dengue epidemic control problem. The Oahu units were offered a speaker for an early meeting.

### VII. Dengue at Wahiawa

Three cases of dengue were reported from Wahiawa, all of which, upon epidemiological investigation, were traceable to dengue infected areas in Honolulu. A fourth case of dengue, which had occurred previously, was also located. An immediate follow-up was made on the three recent cases, including spraying of the residences and surrounding buildings, and complete inspections for the elimination of mosquito breeding places. In addition, all places, both public and private, (including a theater) which had been visited by the dengue victims during their infective periods were thoroughly sprayed for the destruction of adult mosquitoes. Next, a detail of six trained inspectors under the supervision of Mr. F. K. Lee and Sgt. Koch began a complete inspection of the town of Wahiawa for the elimination and treatment of all Aedes breeding places. Complete records are being maintained so that indexes can be computed to determine areas of heaviest breeding.

Some mosquito control activities have been carried out during the past three months by interested citizens and the Office of Civilian Defense. Block Wardens visited all places under their jurisdiction



and distributed educational pamphlets. For the past several weeks, an individual with previous mosquito control experience has been employed on a one day a week basis to supervise a group of about one dozen high school boys in mosquito control inspection activities. Undoubtedly, these campaigns have resulted in a significant reduction in *Aedes* breeding in Wahiawa, but preliminary calculations from our inspections indicate that Wahiawa still has a citywide *Aedes* index of approximately 10%. According to experience in Honolulu, this index is high enough to support considerable transmission of dengue.

Wahiawa is a town of approximately 10000 population, located about 15 miles from Honolulu. It is a congregating and recreational area for a considerable number of military personnel.

#### VIII. Spraying of Airplanes

A complete investigation was made of the technique and efficiency of spraying of inter-island airplanes, due to several complaints of mosquitoes being found in planes while in flight. As a result, it was found necessary to provide written instructions for the airlines employees, and to actually demonstrate spray techniques to the hostesses. Airlines company officials are very cooperative and are making every attempt to carry out the instructions provided.

#### IX. Entomological

In view of the importance of the understanding of the habits, life history, distribution, etc. of any mosquito that is responsible for the spread of disease, plans are being made to study the local vectors of dengue, *Aedes albopictus* and *Aedes aegypti*. The investigations will be primarily concerned with *Aedes albopictus* since the biology of this species, the commonest day mosquito in Hawaii, is little understood. It has been assumed to correspond in a general way to the well-investigated *Aedes aegypti* but more accurate information is desired.

Flight range experiments are being carried out by staining adult mosquitoes at a breeding spot and subsequently recapturing at varying distances from the breeding center. Preliminary laboratory tests have been made to determine a satisfactory method of staining. A study of the distribution and breeding habits of the two *Aedes* species in the city of Honolulu is being carried out by having each inspector bring in samples of larvae, labeled as to location and type of container. The species is then determined and a complete record is kept. Data will be accumulated continuously and analyzed at a later date.

Examinations of the natural breeding places in the native forest are also planned in order to determine possible reservoirs for reinfection of inhabited areas. Another experiment which is important from the epidemiological aspect is the determination of the longevity of adult female mosquitoes which are dengue infected and non-infected. Tests are now being made to develop a satisfactory method of determining the average length of life of the male and female, Aedes aegypti and Aedes albopictus. The various stages of the life histories of the three mosquitoes, Aedes albopictus, Aedes aegypti and Culex quinquefasciatus are being preserved and all will be made into permanent mounts to provide study and record material of the developmental history of these species in Hawaii.

Respectfully submitted,

/s/ Wesley E. Gilbertson

Wesley E. Gilbertson  
P. A. Sanitary Engineer (R)  
i/c Dengue Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE CONTROL  
TERRITORIAL BOARD OF HEALTH  
HONOLULU, T. H.

FIFTH SEMI-MONTHLY NARRATIVE REPORT  
Period Ending November 15, 1943

I. Epidemiology

A. Number and Extent of Cases

During the period ending November 15, a total of 231 cases were reported, bringing the total cases reported to date to 1,070. By comparison, the number of cases reported during the semi-monthly period ending October 31 was 321, and during the period ending October 15 was 221.

A study of the location of these cases indicates that the Kakaako and Buckle Lane-River Street areas, being extremely congested, still continued to be dangerous spots, since there is a large remaining non-immune population living in the areas, thereby being in close contact with the currently infectious cases. A few cases continue to be reported from the Kapalama area, but have not been sufficiently concentrated to warrant the wholesale outdoor spraying measures which have been utilized when a true focus of infection develops. The number of scattered cases appearing throughout the remainder of the city decreased during the period, reflecting the general reduction in mosquito population.

A number of cases were reported among school children, and even among pre-school children. At McKinley High School seven teachers were absent at the same time with dengue, in addition to numerous students who were affected. During the closing days of the period the number of new cases reported each day decreased somewhat.

B. Epidemiological Personnel

On the epidemiological phase of the work, under Dr. J. R. Enright, Director, Bureau of Communicable Diseases, Maj. Shaw and Capt. Stuppy, have now been assigned, both on

part-time, to replace Maj. Spitz who was recalled to his organization. In addition, six Army nurses have been detailed to the Division of Public Health Nursing under Miss Mary Williams to augment the nursing follow-up made on each case.

## II. Spraying Activities

On November 2 two small congested areas received wholesale outdoor and indoor spraying, due to the appearance of a number of cases within the areas:

- (1) A triangular area bounded by intersecting King Street and Kapiolani Boulevard containing a "camp," and
- (2) a "camp" on Pohaku Street near School Street.

The total area is equivalent to approximately three square blocks. (A "camp," in local terminology, is a compact group of small cottages, usually in run-down condition.)

For this work the large Army Chemical Warfare decontamination trucks were not used, but instead, a portable gasoline engine driven sprayer was procured from the Office of Civilian Defense. This unit makes a very satisfactory choice of equipment when the area to be sprayed is not more than a few square blocks in total area.

## III. Inspection and Indexes

Most zones in the city were receiving their fifth cycle of inspection during the period ending November 15. A total of 45,822 premise inspections were made in 1,201 man-days, or 38.1% per man-day. Aedes mosquito breeding was found on 478 premises, or 1.0%. This represents a decrease of .1% in the citywide Aedes breeding index since November 1.

During the period three zones or 4% had indexes above 5%; and eight zones or 10% had indexes above 3%. In 26 zones the indexes increased and in 43 zones the indexes were decreased. The highest zone (6.8%) was 11C, located in Nuuanu Valley. Other zones located in the Nuuanu and Manoa Valleys were among the highest.

The military dengue-restricted areas had the following indexes:

<u>Zones</u>	<u>Area</u>	<u>Indexes</u>
8B, 9B	Buckle Lane-River St.	1.1%, 0.3%
2A, 4, 5A, 5B	Kapalama-Kalihi-kai	0.1%, 1.5%, 0.1%, 0.0%
14A, 14B	Kakaako	1.9%, 0.4%





Figure 1. Outdoor spraying with pyrethrum-base spray for adult mosquito destruction. Standard Army Chemical Warfare Sprayer being used; also utilized, with excellent results, were Bean Tommy Gun Sprayers with 1/32" orifice. (Honolulu Advertiser Photo)



Figure 2. Chemical Warfare Decontamination Truck and Crew. Tank holds 400 gallons; pump maintains 400 lb. pressure with two spray guns in use. (Star Bulletin Photo)







Figure 3. Crew of soldier-inspectors departing for respective zones. Honolulu Chamber of Commerce and Public Health Service employees are also assigned to premise-to-premise inspection activities. (Official Army Signal Corps Photo)



Figure 4. Inspector treating pineapple lily with larvicide. These, together with spider lilies and ape plants are either removed or treated with a long-lasting larvicide to prevent mosquito breeding. (Official Army Signal Corps Photo)





During the period 117,905 potential mosquito breeding containers were located and eliminated by turning over or by larvicidal treatment. The per cent of containers found breeding was 0.8% or 0.1% lower than the last period. The citywide Culex breeding index was 0.1%, or exactly one-half of the previous index.

From a study of the types of containers which continue to show Aedes breeding, it is evident that the interior breeders are now in proportion of one interior to two exterior, whereas initially the proportion was one interior to four exterior. Up to the present time, the principal emphasis has been placed on exterior breeding with interior inspections made upon request or when inquiry revealed the presence of wine bowls or flower vases. It is expected that routine interior inspections will be started at the beginning of the next inspection cycle.

#### IV. Special Activities

##### A. Clean-up Squad

During the period the special clean-up squad, with an average of 23 men and 5 trucks, collected and disposed of 225 loads of mosquito breeding accumulations, consisting mostly of tin cans and bottles. From zone 24-D, located at the entrance of Manoa Valley, a whole truck load of pineapple lilies was collected during the period. That this is a valuable service is testified by the fact that many of the containers were breeding mosquitoes when they were removed.

##### B. Planting of Mosquito Fish

During the month of October, not previously reported, 14 fish ponds, ground pools, and ditches were stocked with top-feeding mosquito minnows for general mosquito control. During the semi-monthly period ending November 15 mosquito fish were planted in three additional artificial fish ponds.

##### C. Accumulations of Old Tires

During the period a total of approximately 5,000 tires located at the yard of Industrial Reclaimers Incorporated were treated with paris green. The question has been raised as to whether it is necessary for the dengue control forces to expend the necessary effort to treat accumulations of old tires with larvicide. Experience has shown that old tires are favorite breeding places for the day mosquitoes inasmuch as they readily collect water and very little

evaporation takes place; and also furnish a sheltered breeding place for mosquitoes. All of the tires which have been treated have been located in the portions of the city which have been foci of dengue infection, such as the Kakaako and Kapalama districts. The firms themselves lacked the manpower for proper handling of these accumulations, therefore, it was felt advisable to proceed immediately with the permanent elimination of these places as mosquito breeders.

## V. Personnel

### A. Total personnel

As of November 15 the following personnel were on duty:

	<u>Field Duty</u>	<u>Total</u>
Army	68	68
Chamber of Commerce	23	24
U. S. P. H. S.	<u>58</u>	<u>68</u>
Total	149	160

During the period 7 employees were separated from the Public Health Service payroll.

### B. Present Administrative and Supervisory Organization

#### Headquarters Office

Wesley E. Gilbertson . . . Officer in Charge  
 F. K. Lee . . . . . Field Supervisor (Director of  
 Rat and Mosquito Control for  
 Chamber of Commerce)  
 John P. Zurlo . . . . . Administrative Assistant  
 Wendell R. McCool . . . . Statistical Records and Public  
 Relations  
 Dr. David D. Bonnet . . . Technical and Entomological

#### District Supervisors

Central District--Tomio Mukaida--Office  
 Robert Mikuni--Field

Lanakila District--Noboru Takamura

Kapahulu District--Seiji Imada

#### Special Activities



Tomio Mukaida--Staff Training  
Robert Mikuni--Trouble Shooting Squad  
Theodore H. Decker--Clean-Up Squad  
S/Sgt. James C. Koch--in charge, Army personnel

#### C. Staff Training

In order to strengthen and improve both the academic and field training of new inspectors, and to develop potential foremen, staff training has been established as a special function of Mr. Mukaida. Prior to acceptance of a new applicant, he is sent out on a field trial, after which a short screening examination is given in order to determine the aptitude of the potential appointee. Following this, individual and group classes are held to acquaint the new employees with the life cycle of the mosquito. Next, several days of field training is provided in locating and eliminating mosquito breeding places, proper approach to householders, and other factors in control work.

### VI. Chamber of Commerce Expenditures for Dengue Control

The Public Health Committee of the Chamber of Commerce of Honolulu, which is in custody of funds acquired through the Public Health Tonnage Charge, under which a voluntary contribution is made on all shipments passing through the port of Honolulu, up to November 15, 1943 had allocated a total of \$21,802.50 to the dengue control program, in addition to the amount of approximately \$2,000 a month being expended by the Rat and Mosquito Control Committee, primarily for salaries of the regular Rat and Mosquito Control squad which has been exclusively on dengue control activities since early August. This represents a very important financial contribution to the dengue control activities. The flexibility in the use of these funds, which are subject only to local control, greatly enhances their value. The use of Chamber of Commerce funds for public relations activities such as the purchase of radio time which is not possible with Federal funds, has been of special benefit. The approximate breakdown in Chamber of Commerce allocations according to their use is as follows:

Salaries--\$14,000  
Insecticide and other control materials--\$4,900.00  
Special education and publicity--\$1,500.00

### VII. Public Education

#### A. Visual Education

1. Three-hundred fifty car advertising cards, size 11" x 21", were placed free of charge in buses belonging to

the Honolulu Rapid Transit Company, for a period of 30 days, where they will be seen an estimated 4,500,000 times by passengers.

2. One hundred posters, size 14" x 22", are being placed in store windows and school bulletin boards throughout the city through the cooperation of the Boy Scouts. These posters will remain in the windows at least two weeks and will be replaced by new designs at intervals of about 30 to 45 days.
3. A display of adult mosquitoes and larvae, together with a large drawing of the life cycle of the mosquito, was placed in the Honolulu Public Library. Photographs of recent spraying and other control activities were arranged with proper captions to augment the life cycle exhibit and specimens. This display was on view for the week ending November 1, 1943, and is being exhibited for one week at the Kapalama Branch Library and then one week at the Kaimuki Branch. It is intended to transfer it to schools and other public places where the maximum number of people may view it.

#### B. Radio

Beginning November 8, Station KGU will carry five spot announcements per week during the morning hours for four weeks; also six spot announcements per week during the evening hours for two weeks. Station KGMB, beginning November 12 will carry twelve spot announcements per week for a period of one month. All copy was prepared by this office.

#### C. Periodicals

The Hawaii magazine is carrying in two issues the complete text of the dengue control story which was presented over the radio by a local special commentator.

The September issue of the Hawaii Medical Journal will carry an editorial on the dengue fever epidemic, based on information submitted by this office.

The October issue of the Board of Health Messenger contains an article on dengue.

#### D. News Releases

During the period a total of 25 newspaper releases appeared in the two English language newspapers. In addition,



releases are being prepared for the following foreign language newspapers: New China Daily Press, United Chinese News, Hawaii Times, and Hawaii Chinese Journal.

#### VIII. The Question of Filariasis

One of the regular meetings of the Dengue Committee was devoted to a discussion of the potential filariasis problem in the Territory of Hawaii. In addition to the regular committee members, the following guests were present:

Lt. Col. du Preist, Medical Inspector, Central Pacific Area  
Dr. Elwood C. Zimmerman, Entomologist, Bishop Museum  
Dr. Shoyei Yamauchi, local practicing physician  
Dr. Satoru Nishijima, an associate of Dr. Yamauchi  
Dr. George W. T. C. Chu, Parasitologist, Territorial Board of Health  
Dr. Bernard Witlin, Bacteriologist, Territorial Board of Health

Dr. Yamauchi discussed fifty cases of chyluria which he had in his own practice, and which he attributed to filarial infection, although none of the cases showed microfilariae in the peripheral blood in day or night blood film examinations. All of these patients had resided for a period of time varying from a few years to as long as 30 years in the Orient. Sixteen out of 45 cases, upon which he had complete case histories, had a definite history of filariasis, i.e., clinical symptoms that were attributable to filarial infection.

Dr. Chu, who has had considerable experience with filarial infections in China, discussed from the parasitological point of view the question of filarial transmission. The local species of mosquito, Culex quinquefasciatus, as pointed out by Dr. Chu, is known to be a vector in many endemic areas for filariasis, but as yet, there is no experimental proof on record to indicate that these mosquitoes are good vectors locally for the several species of human filaria. Dr. Chu suggested that transmission experiments be conducted for the three local species of mosquitoes in the Territory with microfilariae from man in order to determine the degree of susceptibility in the culicine hosts.

Dr. Zimmerman who has seen considerable filariasis in the Fiji Islands where the disease is endemic, pointed out that the habits of the natives of sleeping in the open or in native huts with considerable portions of the body exposed, would provide adequate opportunity for transmission by the day time biter, Aedes variegatus. The infective filariform larvae from the mosquito proboscis would get into the moist skin of the victim by penetrating the pores or injured surface (by mosquito bites) of the skin. Moisture and exposure to repeated mosquito bites

seemed to be important factors in filarial transmission.

The question as to why transmission of filariasis apparently has not occurred in Hawaii, and as to the introduction of cases through military personnel returning from endemic areas was discussed, but on the basis of information at hand, no final conclusions were reached.

#### IX. Dengue Cases on the Outside Islands

During the current period the health officers of the islands of Kauai and Hawaii each reported one case of dengue which had been contracted in Honolulu. Immediate remedial measures were instituted along the lines of elimination of mosquito breeding places, spraying, and public education activities.

In order to prevent the spread of dengue to the other islands, increased attention has been given to the matter of quarantine. The Hawaiian Airlines Company, which operates the inter-island commercial airlines system, has been provided with five sure-shot sprayers, one for each plane, and a quantity of pyrethrum insecticide in order to improve the anti-mosquito measures on inter-island plane traffic. Previously, for a period, aerosol bombs were in use, and later, hand sprayers with commercial insecticide. Regarding human quarantine, the nurses, on their follow-up of dengue cases, are now inquiring as to whether there are visitors in the home from the outside islands, or whether members of the household contemplate a trip. This will provide information which can be used to discourage inter-island traffic and also to notify health officers on the other islands of passengers coming from dengue-infected areas. Due to the sudden onset of dengue and with the appearance of no prodromal symptoms, a case of dengue is virtually impossible to detect while in the incubation stage, thus rendering normal quarantine procedures of no value.

Respectfully submitted,

/s/ Wesley E. Gilbertson  
Wesley E. Gilbertson  
P. A. Sanitary Engineer (R)  
i/c Dengue Control



FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE CONTROL  
TERRITORIAL BOARD OF HEALTH  
HONOLULU, T. H.

FOURTH SEMI-MONTHLY NARRATIVE REPORT  
Period Ending October 31, 1943

I. Epidemiology

A. Number and Extent of Cases

During the period ending October 31, a total of 321 cases of dengue were reported, bringing the total of cases reported to date to 851. By comparison, the number of cases reported during the week ending October 21 was 156, and the number of cases for the week ending October 28 was 133. The figure of 156 cases represents the highest number of cases reported during any seven-day period since the appearance of dengue in Honolulu. The Kakaako district continues to be the heaviest source of cases, and the Buckle Lane-River Street area is the next highest. A few cases were reported from the Kapalama area but were scattered throughout a relatively large district. The Waikiki district continued to be practically free of new cases.

Since the opening of the school year there has been a definite increase in the number of dengue cases reported among school children. For instance, at Pohukaina School located in the Kakaako district, 44 students were reported absent with dengue on October 15. Through the Director of Health Education, Department of Public Instruction, arrangements were made for twice daily spraying of every school room in schools located in areas with high dengue incidence.

B. Restricted Areas

Effective October 23, military authorities established restrictions prohibiting service personnel from entering the Kakaako, Buckle Lane-River Street, and Kapalama areas.

### C. Severity of Cases and Sequelae

There is a wide range in the severity of the case from very mild ambulatory cases to extremely sick, bedridden cases, with delirium and mental disturbances. No difference has been observed in the severity of cases in males and in females, although the white blood count seems to run somewhat lower in females. The usual mental and physical depression following an attack of dengue has been observed, but no other sequelae are in evidence, with the exception of a young Chinese man who reported poor vision following his attack.

- D. In the list of Dengue Committee members included in the report for the period ending September 30, 1943, the name of J. R. Enright, M.D., Director, Bureau of Communicable Diseases, was inadvertently omitted. All epidemiological investigations are being made through that division, the accumulative records maintained, and analysis of the trend of the epidemic charted.

## II. Spraying Activities

### A. New Area Sprayed

A congested area adjacent to the River Street area previously sprayed, was sprayed--both interior and exterior--on October 25. The area is equivalent to approximately three city blocks and consists principally of three-story tenement houses. It has been observed that when dengue gets into a densely populated district such as this, a high incidence of cases usually follows.

### B. Sure-Shot Sprayers and Pyrethrum Extract Received

Toward the end of the current period a shipment was received of 48 Sure-Shot Sprayers and 500 gallons of Pyroicide 20 (2 percent pyrethrum extract in light oil). These sprayers and spray material were immediately put to use by the trouble shooting squad (for interior work) which previously had been operating with blizzard-type sprayers and commercial insecticide. On the mainland the Sure-Shot sprayers had been used with Freon 12 (liquid Freon gas) as a pressure and propulsive agent. However, this office was informed by the War Production Board that Freon 12 has become an exceedingly critical item and the total allocation to the Territory of Hawaii for the month of October was only four cylinders of gas. Therefore, liquid methyl chloride gas is being used as a substitute. Methyl chloride is slightly



toxic to human beings and animals but is not deemed dangerous under the careful control being exercised in the spraying operations. The chief advantage of the Sure-Shot sprayer is that it produces a fog-like spray consisting of particles of minute size, due to the immediate evaporation of the gas, leaving the insecticide suspended in the air.

### C. Results of Wholesale Spraying Measures

From a preliminary study of the incidence of dengue within the limits of the areas which received special outdoor spraying measures, it appears that these activities are definitely effective as an immediate approach to the control of this mosquito-borne disease. There is naturally an inherent lag between the time of completion from spraying activities and the time when the number of cases reported begins to decrease. This is due to the incubation period of the disease and possibly other factors. A complete study of this phase of the control work is now being made and will be reported on later.

## III. Inspection and Indexes

By the end of the period, the fourth cycle of inspection had been completed in all zones. A total of 45,028 premise inspections were made in 1,265 man-days or 35.6 per man-day. Aedes mosquito breeding was found on 533 premises, or 1.1%. The citywide index for the respective semi-monthly periods was as follows:

First period - 10% (spot-check estimate)  
Second period - 1.7%  
Third period - 1.4%  
Fourth period - 1.1%

During the period five zones or 6%, had indexes above 5%; and 12 zones, or 14% had indexes above 3%. In thirty-five zones the indexes increased, some only very slightly, and in forty-two zones the indexes were decreased.

With reference to the zones in which military dengue-restricted areas are located, 8B and 9B (Buckle Lane-River Street) had indexes of 1.5% and 1.2% respectively; 5B (Kalihi-Kai) was 0.2%; 14A and 14B (Kakaako) were 1.6% and 1.9% respectively.

The breeding indexes were highest in the zones located in the Nuuanu and Manoa valleys where rainfall is heaviest, except that two congested zones in the central part of the city have not been sufficiently cleaned up as yet.

During the period a total of 124,108 potential mosquito breeding containers were located and either eliminated or treated by the regular inspectors. The container index (percent of containers actually found with Aedes breeding) was 0.9%, exactly one-half of the index for the previous period.

Rainfall increased somewhat during the period, which will tend to bring out mosquitoes, especially in areas which had been very dry.

#### **IV. Special Crews**

##### **A. Clean-Up Squad Formed**

On October 25 a special clean-up squad of 25 soldiers equipped with five trucks was formed to collect and remove miscellaneous containers such as bottles, tin cans, etc. from vacant lots and other locations where such debris has been collected or accumulated. The crews were equipped with the necessary hand tools and carrying bags to facilitate the clean-up activities. By arrangement with the City and County, Division of Refuse Collection and Disposal, trucks are being unloaded at the Pahoumui Dump on Apili Road. Up to the end of the period these crews had collected and removed 82 truck loads of containers.

##### **B. Accumulations of Old Tires**

A detail of four men was assigned during the period to treat accumulations of old tires with paris green. At the Shintani Shoe Company, which manufactures slippers from old tires, approximately 3,000 tires were individually treated with paris green. In addition, arrangements were made through the War Production Board for release of approximately 500 additional old tire casings which the shoe factory could not utilize. These were hauled to the City and County incinerator where they are being utilized to replace fuel oil in charging the incinerator. Following this, 1,000 tires were treated at the Scott Shoe Company, 250 at the Motonaga Junk Company, and 50 at Tire Recapping Service.

#### **V. Special Student Inspections**

Fifty schools participated in the special student campaign in which each student inspected his own home premises and eliminated all water-holding containers. Of these all but one forwarded the results of their work to this office, where tabulations were made. A total of 25,796 home inspections were made in the city,



in which 30,708 water-holding containers were located by the students and eliminated as mosquito breeders. Of these 4,936, or 16%, were found to actually contain mosquito wrigglers. No attempt was made to differentiate between Aedes and Culex larvae on the Special Student Inspection.

#### VI. Public Education

During the period 32 news releases were carried by the two local English newspapers. Four public talks were given during the period--Waialae School, Realtors Club, Nurses class, and the Engineering Association. Three radio talks were given--one by a special commentator, one as an interview on a regular interview program, and one as a portion of the regular Territorial Health Department program.

Two types of posters were prepared in quantity, one for placing in buses, and the other for posting on bulletin boards and other public places.

The Public Health Committee of the Chamber of Commerce approved a budget of \$1,245 to be used for educational purposes in the dengue control campaign. Under the authorization, provision was made for procuring movie trailers, radio time, posters, and stuffers, as well as the usual newspaper releases.

#### VII. Personnel

As of October 31 there were 147 men on field duty, consisting of 68 Army men, 27 Chamber of Commerce employees, and 52 Public Health Service employees.

It was necessary to separate three employees from the Public Health Service payroll during the period because of unsatisfactory service. In order to avoid training of men who later prove unsatisfactory, new applicants are now being interviewed more carefully and closer scrutiny is given to their past records.

#### VIII. Automotive and Other Equipment

As yet the Army vehicles assigned to this activity have not been recalled. In fact, the number was increased by five vehicles on October 25 when the 25 additional men were assigned to this work. The number of vehicles being utilized on the activity is the minimum which can be used without impairing the efficiency of the employees now assigned to the control work.

The ready availability of the various types of field and office equipment necessary for the conduct of the dengue control program has been of great benefit in expediting the work. As yet no serious shortages have developed for any of the materials and equipment which are needed. It is interesting to note that it was possible to completely equip the initial crew of 100 inspectors in about six days' time. Usually, on the mainland it required a much longer period to procure the necessary items for inspectors' kits.

#### IX. Military Establishments

At the request of Lt. Cmdr. Hering, Medical Officer at Camp Catlin, which is a Marine Corps Base, a survey was made of the area in connection with anti-mosquito measures. Due to the anticipated increase in the size of Camp Catlin, it was recommended that initially a complete clean-up be made of the entire area to eliminate all types of water-holding containers which serve as mosquito breeders. Then a mosquito control detail is to be established which will regularly inspect and control the entire area. Recommendations were also made concerning the elimination of nearby Culex breeding places.

#### X. Historical

From a review of official reports and newspaper accounts of the Territory, certain facts concerning the dengue outbreaks of 1903 and 1912 have been brought to light. The Territorial Board of Health had not established an uniform system of communicable disease reporting at the time of the 1903 outbreak. However, the government physicians on the outside islands indicated in their monthly reports that dengue was severe and widespread that year. The Honolulu Commercial Advertiser, issue of January 29, 1903, stated that a local physician, Dr. Mays, had noted the first appearance of dengue in Honolulu about three weeks previously, and that cases were occurring at that time at the rate of about ten new cases a day. It was stated that the disease was similar to a fever reported 10 years previously, raging principally among the natives, known as "Boohoo Fever." In 1903 local physicians thought that dengue had been introduced by transports returning from Manila, "The germ being carried on the clothing of soldiers, or even in letters and papers." The article concludes by stating that local physicians were extremely busy combating the epidemic. According to the librarian in charge of the Archives, it was almost impossible to get medical or nursing help at that time.

According to the Report of the Sanitary Commission (1912) which was created by an act of the Territorial Legislature of 1911, the first mosquito campaign in Honolulu was inaugurated in 1904.



Several issues of the Commercial Advertiser in 1904 carried stories regarding the control being exercised to rid the area of mosquitoes. Particularly mentioned was the necessity of eliminating miscellaneous small water containers such as tin cans and bottles from the premises of all residents, and oil spraying of ground pools and ditches. It is significant that although physicians in Honolulu apparently did not recognize the dengue of 1903 as being mosquito-borne, an anti-mosquito campaign was inaugurated the very next year. Apparently, the implication of mosquitoes in disease transmission was becoming more widely known just at that time.

Entomologist D. L. Van Dyne in the August 19, 1904 issue of the Advertiser stated that "mosquitoes were first introduced into Hawaii in 1826 at Lahaina, Maui, by the ship Wellington from San Blas, Mexico." These were *Culex quiquefasciatus*. Mr. Van Dyne stated that no Hawaiian word existed for mosquito prior to 1826, and that in 1903 the word "makika" had been in use, being a corruption of the word mosquito. Apparently the *Culex* spread somewhat slowly at first after introduction. In 1850 some areas about 50 miles from Lahaina were still mosquito free, probably because of an intervening mountain range.

According to official Board of Health records, there were 108 dengue cases reported during the year ending June 30, 1912, of which 85 were from Honolulu. In view of the statements made by local residents who were here at that time, the cases must have run much higher, although the exact extent and severity of the epidemic is not known, due to incomplete reporting and the tendency of newspapers at that time to suppress news which might interfere with the increasing tourist traffic in Hawaii. Board of Health reports indicate that there were three cases of dengue reported during the next year and 11 during the year after that. One case of dengue was reported in 1924.

Respectfully submitted,

/s/ Wesley E. Gilbertson  
Wesley E. Gilbertson  
P.A. Sanitary Engineer (R)  
i/c Dengue Control





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
MALARIA CONTROL IN WAR AREAS  
DENGUE CONTROL  
Honolulu, T. H.

SEMI-MONTHLY NARRATIVE REPORT  
Period Ending October 15, 1943

I. Epidemiology

A. Number and Extent of Dengue Cases

To date a total of 530 cases of dengue have been reported in Honolulu, or 221 during the current semi-monthly period. Two serious foci of infection have developed--the Kakaako district and the Buckle Lane-River Street area. A total of 135 cases have originated in the Kakaako area, which received a comprehensive spraying during the week of October 4. The Buckle Lane-River Street area has not had such a high number of cases as yet, but appears to be developing rapidly. The Nuuanu district mentioned in the previous report has not become a focus of infection.

B. Clinical Symptoms and Medical Aspects

The average period of incubation is estimated at nine days. The symptoms at the onset are a headache, backache, a fever of  $102^{\circ}$  to  $103^{\circ}$ . In two or three days the temperature may rise to  $104^{\circ}$  and even  $105^{\circ}$ , followed by severe headache, pain behind the eyeballs, and the "breakbone" feeling. Leukopenia, averaging 4400 is characteristic, with some counts as low as 1100. Complete temperature charts are available only in a few instances, but it appears that the saddle-back temperature curve is not present in all cases. Rash is present in about half of the cases. The average period of illness is seven days. At first most of the cases occurred in males, but recently the number of females affected has been increased, particularly in the Kakaako area, indicating that the disease was contracted at the place of residence. Very few children have been affected, although the number of children, too, is increasing. Cases still continue to be confined to Honolulu on the island of Oahu. A few cases have been reported from rural Oahu and from the outside islands, but these all had a history of having been in Honolulu within the incubation period.

### C. Economic Aspects

It may be stated that although the number of cases has increased during the past thirty days from 25-50 per week to 75-100 per week, the epidemic is relatively mild in comparison with the usual course of dengue epidemics. The sudden occurrence of many cases in a confined area, however, gives warning of what can occur on a citywide basis. If Honolulu should be affected by an epidemic involving 50 to 75 per cent of the population, it would be a serious hazard to the war effort. In addition, there would be very serious economic losses due to loss of time. Several interesting examples of the economic repercussions of the current outbreak have come to our attention. The Honolulu Rapid Transit Company which operates the bus lines, received a reduction in revenue of \$1000 a day during the period that the Waikiki district was restricted to military personnel. The Waikiki Theater had a drop of \$300 a day in gross income. In the Kakaako district the American Sanitary Laundry had 70 people off duty at one time, thus forcing the firm to abandon receiving new work for several weeks, and delaying the company's delivery of work already accepted for at least two weeks. Undoubtedly a number of other firms in the eating, drinking and amusement business located in the Kakaako district suffered severe loss of income during the period of restriction.

## II. Widespread Spraying Activities

When cases occur singly or in a relatively scattered manner, follow-up by spraying and intensive inspection is done by the regular trouble shooting crew. However, when it appears that a large focus of infection is developing, such as previously occurred in the Waikiki district, and, during the current period, in the Kakaako district, it is essential that more intensive and severe methods be utilized to obtain control. A large number of breeding places for Aedes mosquitoes had been eliminated in the Kakaako district where the breeding index was rather high, ranging from 10 to 20 per cent. However, since the life of the adult Aedes mosquito in Honolulu is probably at least 30 days, it is evident that there was a large population of adult day mosquitoes already on the wing. When this occurs in an area where there are several dozen cases passing through the infectious stage every day, it results in a large population of infected mosquitoes. In order to prevent such an area from developing into a citywide hazard, destruction of the adult mosquito is essential. These mosquitoes will find resting places inside and outside of houses. Inside they will be found underneath furniture, in the draperies, back of pictures hanging on the wall, and in other secluded places about the home. Outside they will rest in the foliage of shrubbery, underneath the



house, in outbuildings, and in protected places about the yard. It is essential, therefore, that spraying to kill adult mosquitoes include all these places. The spraying of the Waikiki district during the third week of August apparently was at least a factor in reducing the number of cases appearing in that area during the latter part of September, even though there were two factors which might have reduced the efficacy of that work:

1. It was necessary to use commercial insecticide for the outside spraying, which is injurious to plant material and therefore prevented thorough spraying of shrubbery.
2. Interior spraying was done only where dengue cases had actually occurred.

It is believed that the utilization of high-pressure power sprayers is unique on dengue-yellow fever control work. The so-called "decontamination units" loaned by the Chemical Warfare Department of the U. S. Army for the outside spraying activities were originally designed for spraying of fruit trees in agricultural insect control.

Since the shipment of Pyroside 20 from the mainland had not arrived as yet, arrangements were made with the Chamber of Commerce Health Committee to finance the purchase of a stock solution consisting of one part pyrethrum extract to one part base C kerosene, with a small amount of Vatsol, an emulsifying agent. Enough stock solution was made up for the preparation of 6,000 gallons of spray, using water as a diluent. The cost of the stock solution was \$3,400.00. The water was supplied through the courtesy of the Honolulu Board of Water Supply.

Decontamination trucks and 25 men were supplied by the Army. The area in Kakaako to be sprayed consisted of 46 square blocks. It was estimated that the 6,000 gallons of spray material would be utilized to cover that area, and that four trucks could complete the operation in two working days.

The spraying technique consisted of fogging the atmosphere with the spray, working from premise to premise in an orderly manner, making certain to direct the spray into all outbuildings, under piles of debris and into shrubbery about the yard.

At the same time a crew of eight men equipped with blizzard hand sprayers sprayed the interiors of all residences and other buildings with commercial insecticide. Upon entering a building all doors and windows were first closed, then each room was thoroughly sprayed, and the occupants instructed to keep the doors and windows closed for at least five minutes.

At the time that the spraying of the Kakaako district was in progress, epidemiological records indicated that a sudden increase in the number of cases reported was occurring in the Buckle Lane area, and arrangements were made to continue with spraying activities so as to include that area. Following this, a number of cases were reported nearby along the 1200 block on River Street, which is a tenement district. Since exterior spraying would not be of great value in that district, it was decided to spray the interiors only of the tenement houses along River Street and also additional buildings along Kamanuwai Lane and those between the two streets.

All of the exterior spraying work was completed within three days and the interior spraying within eight days. Almost all of the 6,000 gallons of insecticide prepared for exterior use was utilized, and in addition about 150 gallons of commercial insecticide was used for the interior work. In the Kakaako area of 46 square blocks, there were 785 premises, in the Buckle Lane area of about 8 blocks there were 227 premises, and in the River Street--Kamanuwai Lane zone there were eight tenement houses, making a grand total of 1,020 premises.

A period of two to three weeks elapsed after the Waikiki spraying before there was a noticeable drop in the number of cases reported. It is therefore too early to be able to notice the effects of the spraying operations in Kakaako, Buckle Lane or along River Street.

### III. Inspection and Indexes

The third cycle of the inspection was completed during the current period. A total of 42,322 inspections of premises were made, with 1,108 man-days or an average of 38.2 per man-day. During the period it was necessary to utilize the regular foremen and district supervisors in carrying out the extensive spraying activities described above. However, the field training of inspectors has been continuing as rapidly as possible in order to raise the general efficiency of the inspectorial service.

Out of the total number of premise inspections made, 615 premises were found to have Aedes breeding, or a citywide index of 1.4%. As pointed out in the previous report, because of the spotty mosquito breeding in Honolulu, it is essential to analyze the indexes from the various inspection zones in order to evaluate the conditions.

Eleven of the zones, or about 1.2% of the total number of zones had Aedes breeding indexes for the period of 5% or above. The highest Aedes index in any zone was 11%. The citywide Culex breeding index for the period was 0.3%. The general container



index for Aedes breeding was 1.8%. On an average two Aedes-breeding containers per premise were recorded during the current period.

Analysis of the container indexes reveals that the heaviest breeding is occurring in tin cans, pans, tires, bottles, and ape and lily plants. The citywide Clean-Up Week should reduce the amount of miscellaneous small container breeding. However, a certain amount will remain until more drastic action is taken. The Board of Health has gone on record to the effect that legal action should be taken after proper warning fails to get owners to remove chronic mosquito breeders.

According to experience in Central and South America, the effects of larval control with trained inspectors should become noticeable on the Aedes mosquito population after the fifth or sixth cycle. This period would tend to be lengthened with untrained inspectors, but would also tend to be shortened somewhat with dry weather prevailing, and through cooperative activities of an interested public. Locally, these factors will tend to compensate for each other with the result that about five cycles of inspection should be necessary to reduce the Aedes breeding indexes in the various zones sufficiently to have an effect on disease transmission.

It may be stated that the philosophy of the control program consists of reducing mosquito breeding in all areas as rapidly as possible through application of all known techniques of control, and at the same time watching for localized outbreaks due to infected mosquitoes already on the wing, and applying wholesale spraying measures when this occurs.

#### IV. Rezoning

Rezoning of the entire city to establish inspectorial areas which can be completed within ten days, was delayed until after the third cycle of inspection, due to the spraying activities interfering with previous plans. Beginning with the fourth cycle of inspection and the next semi-monthly period, the total number of inspectorial zones has been reduced by 17, leaving a total of 77 zones. Wherever possible already established zones were combined in order that previous statistical records will continue to be of value.

#### V. Trouble Shooting Squad

Due to the importance of the work being done by the trouble shooting squad, and the increase in the number of cases being reported, the crew was increased to five men and a foreman.

## VI. Clean-Up Week

By proclamation of the Mayor, the week of October 3--9 was established as Clean-Up Week. The regular City Trash and Garbage Disposal trucks were directed to pick up bottles, cans, buckets, and other containers as well as trash and debris on their regular collections. In addition, through the facilities of the City and County Engineer, heavy equipment was provided for removal of over 250 junked auto bodies. By special arrangement the extra collection activity of the garbage trucks was extended for an extra week. The effects of the clean-up activities were decidedly noticeable in the removal of thousands of potential mosquito breeding containers.

## VII. Special Activities

### A. Inspection of the Salvation Army premises in the Manoa district

An interesting example of an inspection of a large plant was provided by a comprehensive coverage of the Salvation Army premises. A total of 13 buildings and the grounds were carefully checked and all mosquito breeding places eliminated. Three vases and two wash tubs were found breeding Aedes inside the buildings. On the outside, 245 trees were inspected in which 86 tree holes were found which were treated with paris green; two tree holes were breeding Aedes; the roof gutters on all buildings were checked; three hundred coconut shells found breeding Aedes; one fish pond was breeding Culex; three pipes were breeding Aedes; 1,600 ape plants were cut down, of which 800 were breeding Aedes; 200 spider lily plants were treated with paris green, of which 50 were breeding Aedes; one tire was breeding Culex; 6,000 cans were removed, of which approximately 2,000 were breeding Aedes; 1,000 bottles were removed, of which approximately 100 were breeding Aedes. About 36 man-days were required to make the inspection.

### B. Special School Spraying Activities

The Interior of the Sacred Hearts Academy was thoroughly sprayed after the occurrence of dengue cases in two children attending the school. Also through the office of Mr. Tate Robinson, Director of Health Education, Territorial Department of Public Instruction, arrangements were made for twice daily spraying of public schools located in the Kakaako and Kapalama areas.



### C. Spraying of Queen's Hospital

Several cases of dengue among nurses at Queen's Hospital resulted in complete spraying of the hospital with pyrethrum aerosol bombs.

### VIII. Special Student Inspection Survey

On October 5 the Special Student Inspection was carried out with each student being provided a sheet upon which he could note the number of containers found on his own premises and also the number found breeding mosquitoes. The complete results have not been tabulated as yet, but preliminary indications are that at least 75% of the sheets were filled out and returned.

### IX. Public Education

During the period 24 news paper releases were carried by the two local English newspapers. In addition, several items have been carried by foreign language papers, and occasionally the radio newscasts have broadcast information regarding the dengue situation.

Five talks were given during the period: Pearl City Lions Club, Entomological Society, and three to the Professional and clerical staff of the Territorial Board of Health.

### X. Staff Education

Thorough training in the technical aspects of control, mosquito lore, and general methods of procedure, are considered to be an important part of the continuation of the Aedes mosquito control work. This training is essential for the civilian personnel employed on the program for the duration, and equally important for the military personnel, who may be detailed to similar activities elsewhere after the present emergency in Honolulu is over. Two large meetings have been conducted, with the entire inspectorial staff being present. Films were shown on the life cycle of the Aedes mosquito and demonstrations provided on types of breeders which are peculiar to Hawaii. After these meetings, it was felt that thereafter meetings should be continued in each district, thereby embracing a smaller group in which more questions could be asked by individual inspectors. True and false examinations were given in order to provoke thinking and discussion on various phases of control and mosquito habits. It is significant to note that the soldier personnel received noticeably higher grades than the civilian personnel.

## XI. Personnel

The total number of field personnel as of October 15 was 113 men, consisting of 49 Army men, 27 Chamber of Commerce employees, and 37 Public Health Service employees. Eight Army men were recalled at the end of the period, due to their companies moving.

In order to increase and improve the quantity and quality of applicants referred by the Civil Service Commission, Mr. Zurlo had a number of conferences with the Civil Service Commission office and the U. S. Employment Service in which our needs were emphasized. To date a total of 48 applicants have been appointed on the Public Health Service payroll, of which 11 have been subsequently separated. Approximately 12 additional applicants failed to report after being interviewed or were not selected because of not being suitable for the work.

## XII. Automotive Equipment

As yet this office has not been notified of any action taken regarding the request made through the office of the Military Governor for automotive vehicles. At present there are 8 Army vehicles assigned to the work, 4 from the Office of Civilian Defense, and one from the Chamber of Commerce. The Territorial Board of Health received by transfer from the Board of Agriculture, 4 vehicles which are being repaired prior to assignment to the dengue control work. Upon appraisal of these vehicles it is believed that these vehicles should be placed on "limited service" duty. Word has been received that the two Public Health Service vehicles shipped from Atlanta have arrived in California. Arrangements have been made with the Army Port and Service Command for transshipment to Honolulu.

## XIII. Statistical Records

The gathering and compilation of statistical records is essential to the operation of Aedes control program. It is necessary to know where the heaviest breeding is occurring, what types of containers are the heaviest breeders, where potential breeders are concentrated, whether the techniques of control on the various types of breeders are adequate, and whether a reduction in the breeding indexes is being accomplished. The inspectorial staff on the Honolulu dengue control program is approximately five times larger than the staff on any single control program on the mainland. The inspector's sheets were devised to fit local conditions. A clerical staff has been established to compile the records available from the inspectors sheets and to compute the various indexes which are needed



for analyses of the work. From the various statistics available, an adequate basis will be provided for supervision of the work and also the necessary information will be provided to the Army concerning potential danger spots from the standpoint of possible restricted areas.

XIV. Administration

The administrative functions under Mr. Zurlo are becoming well established and have resulted in clearing up all deficiencies which existed. Local purchases have been paid for, employees placed on semi-monthly payroll status, and other administrative details satisfactorily covered.

Respectfully,

/s/ Wesley E. Gilbertson  
P.A. Sanitary Engineer (R)  
i/c Dengue Control





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
DENGUE MOSQUITO CONTROL  
BOARD OF HEALTH  
TERRITORY OF HAWAII

SEMI-MONTHLY NARRATIVE REPORT  
Period Ending September 30, 1943

I. General Organization and Operation

A. Personnel

1. The total number of field employees on the dengue control program as of September 30 was 105. Of these, 85 were assigned as zone inspectors, 12 as foremen, 3 as district supervisors, and 4 on trouble shooting duty. The number of army men doing zone inspection work was 45, Chamber of Commerce employees, 16, and Public Health Service, 24.

B. Inspection Activities and Breeding Indexes

1. The city is being covered on a ten-day cycle (average). Some of the initially established zones can be covered in a period of five days; others require more than ten days. The first complete cycle has been finished and most of the zones are nearing completion of the second cycle of inspection. Adjustments will be made in the size of the zones before the third cycle is begun so as to approach the ten-day cycle as nearly as possible. Exteriors of all premises are being checked and interiors of residences are being inspected when requested by the householder, and where water plants are growing inside the house. As the program continues, it is planned to place more emphasis on interior inspections because the outside breeding will gradually be reduced through control activities.

During the period September 16 to September 30, a total of 48,086 inspections of premises was made, with 1,081 man-days of labor, or an average of 44.5 per man-day. A total of 861 premises were found breeding Aedes or a general outside breeding index of 1.7%. Premises

breeding *Culex* totaled 199, or an index of 0.4%. There are two factors which tend to reduce the importance of the citywide *Aedes* breeding index on this particular project.

- (a) Many breeding places are being missed due to lack of experience of the inspectors.
- (b) Due to the wide range of rainfall over the Honolulu city area, mosquito breeding varies (considerably) from less than 10 inches per year to over 150 inches. A much better picture of the mosquito density is afforded by analyses of the various zone indexes. Of the 91 zones which have been inspected, 26 had daily breeding indexes above 5 percent and 23 had daily breeding indexes above 10 percent. The highest is 46.1 percent. About 16% of the established zones had period *Aedes* breeding indexes above 5%. At the present time it is not possible to determine whether 5% is the lowest breeding index which will support an epidemic, as in the case (approximate figure) with yellow fever. In fact, it appears that the occurrence of dengue cases during the month of September is more correlated with the density of human population than with the mosquito breeding indexes. This could be explained on the basis of the short flight range of the mosquitoes. The zones with the highest breeding indexes are mostly up in the valleys, which receive several times more rainfall than the lower flat portions of the city. However, in the valleys the premises are large and the residences are widely separated. This makes it much less probable that the mosquitoes which are present will make the longer flight required to transmit the disease from household to household.

## II. Epidemiology

### A. Number and Extent of Cases

1. Total number of dengue cases up to September 30 was 309. These were scattered over the entire city area. In addition to the original focus of infection in the Waikiki district, another major focus has developed in the Kakaako area, which is near the center of town. In Nuuanu Valley a number of cases have appeared, although they are sufficiently scattered so that it cannot be



said that a true focus is developing. During the month of September a total of 171 dengue cases was reported to the Board of Health, or an average of about 43 per week. It seems very probable that if the mosquito population is significantly increased, an explosive outbreak over the entire city would result because of the number of cases passing through infectious stage each day. Epidemiologists estimate that about 20% of the cases are unreported because of doctor's negligence or patient's failure to report or call a doctor.

## 2. Coordination with control activities

- a. The names and addresses of all new cases are provided each day by the Bureau of Communicable Diseases in order to assure placing emphasis on control activities in infected neighborhoods. Regular conferences are held with the Epidemiologists in order to make use of any information which might lead to discovering new foci of infection. A special trouble shooting crew follows up each dengue case, as described later in this report.

## III. Mosquito Distribution and Habits

### A. Preliminary Field Survey

1. A preliminary survey of *Aedes* breeding in Honolulu was essential before starting the citywide ten-day inspection cycle. The objects of the survey were: (1) To become familiar with mosquito breeding in the various sections of the city as a basis for establishing inspection zones; (2) To discover unique local breeding spots; (3) To determine the ratio of *aegypti* to *albopictus*; and (4) To obtain a preliminary estimate of the breeding index.

Three experienced inspectors were used under the constant personal supervision of Mr. Lee, the General Foreman. Dr. Usinger worked with each inspector in succession throughout the survey. Specimens were collected from each container found breeding and these specimens were reared through to facilitate identification.

It was found: (1) that mosquito breeding was very low in the dry portions (20 inches of rain per year or less) of the city, including Waikiki (index 4%)

where concentrated control work was done; (2) that the *Aedes* mosquito breeding index was 83% in Nuuanu Valley, where the average rainfall is 160 inches per year; (3) that aloe plants, pineapple lilies and other garden or forest plants of this type collect quantities of water and are the principal sources of mosquitoes in the wet parts of the city and in the native forests; (4) that only 15% of the day mosquitoes (*Aedes*) were aegypti; the remaining mosquitoes being *Aedes albopictus*; (5) that the index for the entire survey was 13.3%.

All aegypti breeders except one were found in town, whereas albopictus was found everywhere from the congested city area up into the wet valleys and mountains. Aegypti was found in ant cups, water plants, an ice cream refrigerator box, and a water valve box. Albopictus was found in ant cups, flower pots, tin cans, bottles, a paper box, jars, a large shell, an auto tire, a tank, and in aloe plants and pineapple lily water cups.

## B. Survey of Literature

1. A survey of the literature on albopictus reveals it to be a vector of dengue, yellow fever, equine encephalomyelitis, bird malaria, hemogregarines of geckoes, and filariasis of man and dogs. Despite this emplied wide range of hosts, precipitin tests of engorged females in Indo-China (Toumanoff) showed human blood, even when the mosquitoes were collected in stables.

Toumanoff (1939) carried on extensive crossing experiments with aegypti and albopictus. He found that female albopictus crossed readily with male aegypti; the  $f_1$  generation resembling albopictus in every case. The reciprocal cross was less successful. Only one  $F_1$  specimen was obtained and this resembled aegypti. Although crosses were obtained between the two species in Tonkin, aegypti from Calcutta would not cross with albopictus from Tonkin and vice versa. This suggests the possibility of local strains, probably of albopictus since aegypti is not a native of that section of the world.

Robertson and Hu (1935) made an intensive study of the habits of albopictus in Shanghai. Their report indicates that the "tiger mosquito," albopictus, resembles aegypti so closely that the two species could be considered as identical from the standpoint of control.

Actually, there are certain minor differences which profoundly influence the distribution and relative abundance



of the two species. Albopictus has a slightly longer life cycle (18 days) than aegypti (17 days) in the summer season in Shanghai, but, significantly, albopictus has a shorter life cycle (24 days) than aegypti (27 days) in the winter, indicating a greater tolerance for cold weather.

Reports from India, Australia and the Philippines state that aegypti is the dominant form in cities and hence is the principal vector of dengue. The opposite situation is true in Honolulu, according to surveys since 1912 showing albopictus to be much more abundant than aegypti. The explanation for this situation may lie in the topography of the Hawaiian Islands. Unlike the low flat coastal cities of the Orient, Honolulu is situated adjacent to and actually in between and on high mountains. Densely forested ridges extend well into town. Albopictus breeds in tremendous numbers throughout the forest at high elevations where the mean temperature is 10° lower than in the city. Thus it is evident that albopictus is favored by forest adjacent to Honolulu. The flight range of albopictus is apparently quite limited as determined by Senior White in India, so effective control of dengue appears to be possible in Honolulu. However, eradication of Aedes in the Hawaiian Islands may be considered as impossible.

#### IV. Special Trouble Shooting Crew

- A. A crew consisting of four men and a foreman receives each morning a list of the newly reported dengue cases and proceeds immediately with spraying of the interiors of the residences and other buildings on the premises of each case. A detailed inspection is also made to eliminate all mosquito breeding places, inside and outside. Adjacent premises are covered in the same manner. There has been ample demonstration of the value of this crew because each time that a small focus of two or three cases has occurred, the trouble shooters have been able to locate actual mosquito breeding on the premise or in the neighborhood.

#### V. Liaison With Military

- A. Army

This office has kept in constant touch with the office of Brig. Gen. King, Surgeon, Central Pacific Department. Pro-

vision has been made for forwarding to his office reports on mosquito breeding indexes regularly and also to furnish special information from time to time as required. A description of the entire organization and operating methods, together with samples of the equipment and printed materials in use, and a zone map of the city have been furnished to the Surgeon's office to fully acquaint his staff with the control program. Official visits have been made to two army posts--Ft. DeRussy and Hickam Field--in connection with mosquito control activities. Sufficient phenothiazine has been furnished to the Corps of Engineers to treat all fire barrels located in the various construction and material yards.

#### B. Navy

A number of conferences have been held with the Epidemiologist and control personnel from the office of Admiral Chambers, District Medical Officer, 14th Naval District. Phenothiazine has been furnished so that comparative tests can be made against the larvicide which the Navy is now using.

### VI. Inter-Island Quarantine

#### A. Spraying of Planes

All planes, military and commercial, which operate between the Islands are receiving interior spraying with aerosol bombs. These bombs were supplied by the Army through this office after a survey of spraying technique in both passenger and freight planes revealed that spraying equipment and supplies were not effective.

#### B. Survey of John Rodgers Airport

A detailed survey was made of John Rodgers Airport which is utilized for planes engaged in inter-island traffic, in order to assure absence of Aedes breeding at the location where planes take on passengers and cargo.

#### C. Notification of Passengers

Passengers from the island of Oahu to the outside islands are presented an instruction sheet concerning the nature and symptoms of dengue, and given warning to report suspicious symptoms to a personal physician or the local Board of Health.

### VII. Educational Activities

#### A. Movie Trailer



1. A two-minute sound movie trailer on 35 mm. film has been prepared for commercial exhibition. The trailer provides a brief glimpse of the life cycle of the mosquito and demonstrates how the householder can correct the more common types of Aedes breeding places. The photography was done by the Army Signal Corps, the sound narrative commentator was provided by the Army Special Service Department, the processing was carried out by the Navy Photographic Department, and the sound recording was handled by a commercial company. Arrangements have been made with the management of two theater chains to exhibit the trailer in their theaters on the island of Oahu first, and later on the outside islands. About 80 theaters will show the trailer.

#### B. Special Student Survey

1. Arrangements were made for the 50,000 students who attend Honolulu's public and parochial schools to make mosquito inspections of their own premises and to correct all breeding places during the first week in October. This activity coincides with a city Clean-up Week. Special survey sheets will be distributed by the teachers through the students. On the sheet the student-inspector will indicate the number of water containers eliminated on his premise, the number in which mosquito breeding was actually found, and any special mosquito problems occurring on his premises. Results will be reported later.

#### C. News Releases

1. During the period a total of twenty news releases appeared in the two local papers. These were released through the Division of Health Education of the Territorial Board of Health. The local papers are cooperating, and will carry any significant news story on the dengue control work.

#### D. Talks

1. At a special meeting of school principals, teachers, health educators, and student leaders, talks outlining the current dengue situation were presented, requesting aid from the schools in carrying out the special student inspection mentioned above. Demonstrations were provided to show the types of breeders commonly found in Honolulu, and a film on mosquito life cycle was exhibited.

### VIII. Dengue Committee

- A. A committee consisting of Dr. Charles L. Wilbar, Jr., President, Board of Health, Dr. Richard Lee, Director, of Public Health,

Mr. Tay, Director, Bureau of Sanitation, Miss Williams, Director, Bureau of Public Health Nursing, Mr. F. K. Lee, Chamber of Commerce Mosquito Control Supervisor, Maj. Spitz, M.C. U. S. Army, Lt. Allen, U. S. Navy, Lt. Nebelung, U. S. Navy, Lt. Stanes, U. S. Navy, Dr. Usinger and Mr. Gilbertson meet weekly to report on the various phases of the dengue epidemic and to discuss arrangements for control activities. This committee serves as a clearing-house for all the agencies interested in dengue control.

#### IX. Administrative Activities

- A. With the arrival of Mr. John P. Zurlo, Administrative Assistant, the entire administrative phase of the program was turned over to him. Initially it will be necessary to establish procedures to be followed for handling personnel and fiscal matters, taking into consideration the relatively slow service through regular mail channels. Tentative procedures have been set up for handling such matters as are necessary via radio and airmail. A summary of these has been forwarded for consideration and approval.

#### X. Personnel

##### A. Army

1. The special detail of 50 soldiers from the Medical Department were assigned on a one month basis. Therefore unless the original plans are revised, these men will be recalled on October 15. It is planned to release men in small groups earlier than October 15, if sufficient civilian help can be recruited and trained as replacements. At the time that the 50 soldiers reported for duty, arrangements had not been completed for feeding the soldiers for the noon day meal. For a period of about one week each man was allowed 50 cents a day through Chamber of Commerce health funds to pay for noon day lunch.

##### B. Chamber of Commerce Employees

1. The original group of Chamber of Commerce men employed for dengue fever control activities has now been reduced somewhat by resignations, but they will be replaced as rapidly as possible by new appointees.

##### C. Public Health Employees

1. Civil Service recruitment has been rather slow and so, if referrals do not materially increase, it will not be



possible to maintain the present level of inspection if the soldiers are withdrawn on October 15. Efforts have been made to locate other recruitment channels in order to supplement official referrals by Civil Service. In general, the quality of civilian help has been low, although a few good men have been employed. The established wage scale fits in with salary schedules already being followed by the Board of Health and the Chamber of Commerce. However, unless it is possible to considerably improve the number and quality of civilian field employees in the very near future, it is believed that an upward revision of the salary schedule should be considered. As would be expected with this type of personnel, there is considerable absenteeism and turnover. Out of 38 appointments seven have already been separated. In spite of the difficulties mentioned above, field inspectors are being hired on an average of one per day.

#### XI. Automotive Transportation

- A. The program has been operating with two less vehicles than the minimum needs. Due to inexperienced inspectorial personnel, constant field supervision is essential. This requires a vehicle for each foreman. The eight army vehicles which were provided on temporary loan are now needed by the Army for the purpose for which they were originally intended. The Board of Health has been able to procure four used vehicles which are being assigned to mosquito control activities as soon as necessary repairs can be completed. All possible sources of obtaining vehicles have been contacted; American Red Cross, Office of Civilian Defense, rental companies, U. S. Engineers, and the Army. In order to assure maintenance of adequate automotive transportation the President of the Board of Health has requested through the Governor's office that the Commanding General make six vehicles available as soon as possible.

Respectfully,

Wesley E. Gilbertson  
P.A. Sanitary Engineer (R)  
i/c Dengue Control





FEDERAL SECURITY AGENCY  
U. S. PUBLIC HEALTH SERVICE  
MALARIA CONTROL IN WAR AREAS  
DENGUE CONTROL  
HONOLULU

SEMI-MONTHLY NARRATIVE REPORT  
Period Ending September 15, 1943

I. Conditions Upon Arrival

- A. Number of cases--148. (These are civilian cases only. The number of military cases, which was not released to the public, did not reach serious proportions.)
- B. Distribution of cases
  - 1. Cases were distributed over most of the city, the Waikiki area being the only one which could be considered as serious. This area had been placed under military restrictions by Army and Navy authorities on August 8.
- C. Corrective measures
  - 1. Field mosquito control activities
    - a. A crew of approximately 35 men was on duty engaged in inspection and spraying activities. This staff was employed through the Chamber of Commerce Health Committee tonnage tax funds, and comprised 9 experienced rat and mosquito control men, a group of temporarily employed mosquito inspectors, plus five soldiers detailed from the Medical Department.
    - b. Equipment consisted of seven automotive vehicles each equipped with one larvicide sprayer ladder, and an insecticide sprayer and necessary supplies.
    - c. The method of spraying consisted of making inspections and such corrective work as could be accomplished with the equipment at hand, proceeding in widening areas from the locations of dengue cases. Movable containers were inverted, but no permanent larvicides such as paris green or phenothiazine, were in use.

Houses where dengue cases occurred were sprayed with insecticides. Close to one-half of the city area had been covered through these operations.

## 2. Educational activities

- a. News releases. Daily news releases were being made on the number and location of actual and suspected dengue cases. Local papers carried a few stories with an appeal to the public for cooperation in mosquito control work.
- b. Radio. A number of spot announcements were carried by the local radio stations.
- c. Pamphlets. A one page leaflet was distributed to householders by inspectors.

## 3. Mosquito control by military authorities

- a. The Medical Departments of the Army, Navy, and Corps of Engineers had assisted in close inspection of military areas accompanied by the use of oil larvicides as necessary.

## II. Management of Cases

- A. All cases and suspected cases were investigated by a physician for confirmation of diagnosis. Public health nurses assisted by getting patients under bed nets. Householders were instructed in mosquito protective measures, such as spraying. Case histories were made and possible contact points established. The death reported as attributable to dengue was an elderly female and involved other serious complications as contributing causes.

## III. Liaison Established Upon Arrival

### A. Military

1. Contact was made immediately with Brig. Gen. King, Surgeon, Central Pacific Department, U. S. Army, and Admiral Chambers, 14th District Medical Officer, U.S. Navy, concerning supplementary aid to the mosquito control program through U. S. Public Health Service facilities. Both officials agreed to cooperate in every way possible.

### B. Civilian

1. A meeting was held with the Chamber of Commerce at which it was agreed that all personnel would be combined to form a single control unit.



#### IV. Offices Established

- A. Office quarters are being furnished by the Territorial Board of Health in the main building for central technical and administrative functions. For operational purposes the city has been divided into three districts. District field supervisory offices are quartered in the Board of Health Centers at Kapahulu and Lanakila and the main office building.
- B. Office equipment and supplies
  - 1. The Board of Health is furnishing necessary office furniture at two of the District offices. It has been necessary to purchase desks and other office equipment and supplies for the central office and the third district office.

#### V. Personnel

##### A. Personnel needs

In view of the wide distribution of dengue cases over the city and the general breeding found, it is essential that a complete citywide control program be operated. A total staff of approximately one hundred men, including the Chamber of Commerce employees, is necessary.

##### B. Civil Service Recruitment

- 1. Immediate contact was made with the Honolulu Federal Civil Service Commission office and requests made for seventy CPC-3 (inspectors) and five CPC-5 (foremen). Up to September 10 only nine men had been referred by the Civil Service Commission. All of these were appointed.

##### C. Military

- 1. In order to obtain an adequate staff to place the control program on a citywide 10 day inspection cycle basis, arrangements were made to obtain fifty soldiers from the Army. These arrangements were confirmed by a letter from Dr. Charles L. Wilbar, Jr., President, Territorial Board of Health, through Governor Stainback, to the Office of Military Governor. The fifty soldiers are being utilized as inspectors on a temporary basis until adequate civilian personnel becomes available and trained. These men reported September 15, and together with military personnel previously assigned to the work, Chamber of Commerce employees, and Civil Service Commission appointees, make a total staff of approximately one hundred men.

## VI. Field Equipment

### A. Automotive

1. A total of thirteen automotive vehicles are now in use on the program obtained on temporary loan from the following sources:
  - a. Army--eight vehicles
  - b. Office of Civilian Defense--five vehicles

These vehicles are being fueled and maintained by the owning agency.

### B. Inspectorial Equipment

1. Materials and supplies of excellent quality were purchased, though with some difficulty, to assemble one hundred inspector's kits, consisting of the following items: mirror, flashlight, paris green bulb, bottle of kerosene, bottle of phenothiazine, report folder, chalk, pencil, referral slips, educational pamphlets and carrying bag. In addition, each truck will be supplied with containers for carrying supplies of the three larvicides to the field men, the previously used knapsack, sprayers, and insecticide sprayers.
2. New inspector's daily report and referral sheets were devised to fit local conditions and were reproduced in quantity. Assistance of a local newspaper artist was enlisted in the preparation of a new educational premise bulletin for distribution to householders. Enough of these have been produced to furnish Health Officers on the outside islands with supplies with which to carry on anti-Aedes campaigns.
3. Each inspector is identified by an arm band, several inches wide, bearing the words "Dengue Control."
4. Mimeographed leaflets of detailed instructions were made up and issued to the foremen and inspectors.

## VII. Spot-check Survey of the City

- A. A 4-day spot-check survey of the city was made by Dr. R. L. Usinger, utilizing four experienced mosquito control inspectors.



## B. Results of Survey

### 1. Breeding and Indexes

- a. It appears that the general overall breeding index of the Aedes mosquitoes (aegypti and albopictus) in Honolulu is approximately ten per cent. At the time of the survey, the range was from about five per cent in the Waikiki district, which had received a concentrated campaign of inspection and spraying, to about ninety per cent in the heads of the valleys such as Nuuanu, which receive heavy rainfall. The Aedes population thus far sampled consists of thirty-two per cent aegypti and sixty-eight per cent albopictus. Undoubtedly, the breeding index of ten per cent, which is not seriously above the threshold of sanitary importance, is the reason there has not been an explosive outbreak of dengue in the city, but rather a scattering of from thirty to fifty cases per week. The season has been very dry, thereby curtailing mosquito breeding. Usual experience here indicates that rainfall will increase during the latter part of October and continue through February. It is hoped, therefore, to obtain effective control before the rainfall increases.

### 2. Types of Breeders Found

- a. All of the usual types of breeders found on the mainland are found in Honolulu, such as barrels, tanks, tubs, buckets, pails, jars, urns, bottles, tin cans, tire and chicken pans. Cisterns are not too plentiful, and where found they are usually too foul for Aedes. The principal new problems encountered are spider lilies, pineapple lilies, ape (ah' pee) plants, and tree holes. The plants are very numerous and have cups which hold as much as one-half pint of water. It is planned to utilize paris green on the ape plants and phenothiazine on the lilies where there is some danger of injuring the plants.

## VIII. Method of Operation

### A. Official Status

1. The entire program is under the Bureau of Sanitation, Mr. S. W. Tay, Director.

## B. Zoning

1. Utilizing the twenty-nine existing voting precincts as a basis, the entire city has been divided into ninety-four inspection zones suitable in size for seven to ten day coverage by one man.

## C. Supervision

1. Foremen--12 foremen have been designated, each having supervision over from six to eleven men.
2. District supervisors--three district supervisors are provided, each with four foremen under his supervision.
3. Field supervision--Mr. F. K. Lee, formerly Director of Rat and Mosquito Control for the Chamber of Commerce Health Committee has been designated as field supervisor.

## D. Inspection-Correction Work

1. Inspectors will proceed in an orderly manner from premise-to-premise and block-to-block in covering their assigned zones. The usual method of marking street corners and "V's" in front of residences is being utilized. Correction techniques utilized on the mainland are being employed.  
Problems encountered by inspectors which cannot be handled are being referred in writing to the foreman for attention. Military foremen have been placed over military inspectors, and civilian foremen are over civilian inspectors. Arrangements have been made with Dr. Enright, Director, Division of Communicable Diseases, and Major Spitz, M. C., who has been assigned to the Board of Health for epidemiological studies, to obtain current information as to any existing foci of infection so that concentrated effort can be placed on control activities in these areas.

## IX. Records

- A. Inspector's records will be compiled and necessary analyses made, to be used as guides to control operations in the placing of men and choosing of control techniques. The following data will be obtained, by zones, districts, and for the city as a whole:



Total number of premises inspected  
Total number of premises breeding Aedes  
Aedes breeding index  
Total number of containers inspected  
Total number of containers breeding Aedes  
General container index  
Total number of each type of container inspected  
Total number of each type of container breeding Aedes  
Individual container index

X. Public Education

A. News Releases

1. The public has been kept continuously informed regarding the development and aims of the control program. Direct appeals have been made to householders to clean up their own premises to eliminate mosquito breeding. Due to the postal situation here, only a few sample clippings are attached.

B. Other Educational Activities

As time permits, arrangements will be made to make full use of other channels, such as the schools, service clubs, and dodgers.

XI. Waikiki Restriction Lifted

- A. Effective September 13, military authorities lifted the restriction on most of the Waikiki District, following study of the entomological survey results and the current epidemiological picture. Though no apparent differential in mosquito densities was found in different parts of the Districts, the restrictions were retained on a few small zones.

XII. Future Reports

- A. More complete entomological data will become available soon and will be forwarded. Summary reports of actual operations will also be sent.

Respectfully,

---

R. L. Usinger  
P. A. Sanitarian (R)

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Wesley E. Gilbertson  
P. A. Sanitary Engineer (R)





TERRITORY OF HAWAII  
BOARD OF HEALTH  
DENGUE MOSQUITO CONTROL

September 10, 1945

To: Dr. C. E. Pemberton, Chairman  
Sub-committee on Mosquito Control  
Post-War Planning Health Committee  
Chamber of Commerce of Honolulu

Through: Dr. C. L. Wilbar, President  
Board of Health

Mr. B. J. McMorrow, Director.  
Bureau of Sanitation  
Board of Health

From: Arve H. Dahl, Officer in Charge  
Dengue Mosquito Control

Subject: Plans for Permanent Mosquito Control in the  
Territory of Hawaii

As requested at the last meeting of the sub-committee on mosquito control, I am forwarding for consideration by the entire committee a plan for permanent mosquito control in the Territory of Hawaii. This plan is essentially identical to the one outlined verbally at the last meeting. Modifications were made following discussions with Dr. Wilbar, President, Board of Health, and Mr. McMorrow, Director, Bureau of Sanitation.

It is Dr. Wilbar's desire that your committee consider this entire plan and make recommendations for its revision or approval before he submits it to the Governor for approval and funds.

Respectfully,

Forwarded: 9/13/45

C. L. Wilbar, Jr., M. D.  
President, Board of Health

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Arve H. Dahl  
P. A. Sanitary Engineer (R)  
i/c Dengue Mosquito Control

AHD/en

Forwarded: 9-12-45

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F. A. Schramm  
Asst. Director, Bur. Sanitation





- A. In considering the post-war project for mosquito control for the Territory of Hawaii, the following points must be considered:
1. There are three species of mosquitoes present in the Territory of Hawaii, each of medical importance.
    - a. The two-days mosquitoes, Aedes aegypti and Aedes albopictus are vectors of dengue fever and yellow fever. The control of these diseases has been demonstrated by the control of these mosquitoes. Both species are domestic mosquitoes which breed in artificial and natural containers and require premise to premise inspections for their control besides treatment of all city storm-drains and catch-basins, etc.
    - b. The night mosquito, Culex quinquefasciatus, is the same mosquito that has been proven responsible for transmitting filariasis. Control of this mosquito involves the treating of streams, swamps, ground-pools, storm-drains, and many of the same containers treated for Aedes control.
  2. The real danger of introduced mosquito-borne diseases in the Hawaiian Islands lies in the City of Honolulu where all transient visitors arriving in the Territory land. Furthermore, future travel will largely be by airplane, bringing persons to Hawaii from areas where dengue is endemic, such as Fiji, within the incubation period. It is, therefore, important that maximum efforts be expended in Honolulu to prevent introduction of diseases which might also spread to the other islands.
  3. The second point of danger which should be safeguarded is Hilo, Hawaii, the second largest city in the Territory. The greatest amount of travel between the Hawaiian Islands is between Honolulu, Oahu, and Hilo, Hawaii. A small program similar to the Honolulu program should be operated.
  4. A Division of Mosquito Control should be established under the Bureau of Sanitation, Board of Health, Territory of Hawaii, immediately.
- B. The Division of Mosquito Control of the Board of Health would perform the following functions:

1. Perform the necessary mosquito control activities in Honolulu and Hilo to minimize the danger of an outbreak of mosquito-borne diseases. A low Aedes mosquito breeding index in Honolulu should be maintained to prevent another dengue epidemic and to control the potentially dangerous and annoying Culex quinquefasciatus mosquito.

2. These units must be comprised of a nucleus of well-trained men who, in the event of an emergency, would train additional workers and direct expanded mosquito control activities. In addition, the Division's control organization must be on a mobile unit basis; i.e., available to go to any part of the Territory to handle mosquito control problems.
3. All control work must be designed to use the best and most effective larvicides and adulticides available in the most economical manner. This will require the maintenance of a continuous supply of larvicides and adulticides to meet any emergency. At present, pyrethrum and DDT larvicides and adulticides are recommended.
4. Continuous research should be done to determine more effective methods of dispersing larvicides. This section would include in its studies; dispersal of DDT by airplane versus ground dispersal methods; the effect of DDT and other larvicides on beneficial insects.
5. Continuous surveillance around airports and ports of entry for possible new species of mosquitoes should be maintained. This information can be obtained largely through cooperating quarantine officials; however, some field entomological checking should be done. In the event that a new species of mosquitoes is found, appropriate control or eradication procedures must be instituted at once.
6. Educational work should be continuously promoted through the Board of Health's Division of Public Health Education. Efforts to include satisfactory class study on mosquito control throughout the public school system are necessary.

C. Basic Plan of Organization for the Division of "Mosquito Control."  
(Attached is the complete personnel outline recommended showing Territorial Civil Service ratings.)

1. Personnel:

- a. Director: Professional Sanitary Engineer, P-5:  
Supervisor of all mosquito control activities;  
coordinating work with other agencies; educational activities. Must be a professional Sanitary Engineer trained in public health with special emphasis on mosquito or tropical disease control.
- b. Medical Entomologist: Graduate medical Entomologist, P-4: Responsible for research on methods of using all types of larvicides and adulticides. Responsible for surveillance activities to detect possible new



introduced species of mosquitoes and other insects of public health importance besides maintaining liaison with established quarantine officials. To assist in evaluating at all times the work of the Division.

- c. Clerk-Stenographer, CAF-4: Stenographer for Division; keep statistical records on field work; and complete files.
- d. Supervising Mosquito Control Inspector, IN-5: Responsible for supervising a crew of five mosquito control inspectors. Normal operations will consist of: premise to premise inspections for detection and correction of Aedes mosquito breeding places using DDT larvicides; and use of power-spray equipment for adulticiding work.
- f. Mosquito Control Inspector, IN-4: Special positions to operate motorcycle units: (1) to larvicide regularly all storm-drains, etc., and regular breeding spots reported by the inspectors; and, (2) to take care of all supplies mixing larvicides, equipment, and handle special referrals.
- g. Mosquito Control Inspectors, IN-3: To make regular premise to premise inspections for detection and correction of Aedes mosquito breeding places using DDT larvicides; to operate power-spray equipment for eradication of adult mosquitoes.
- h. Clerk-typist, CAF-2: To keep operational and statistical records on field operations.

Note: All personnel will be trained in all phases of mosquito control. They will serve as a nucleus for an expanded program in the event of an emergency.

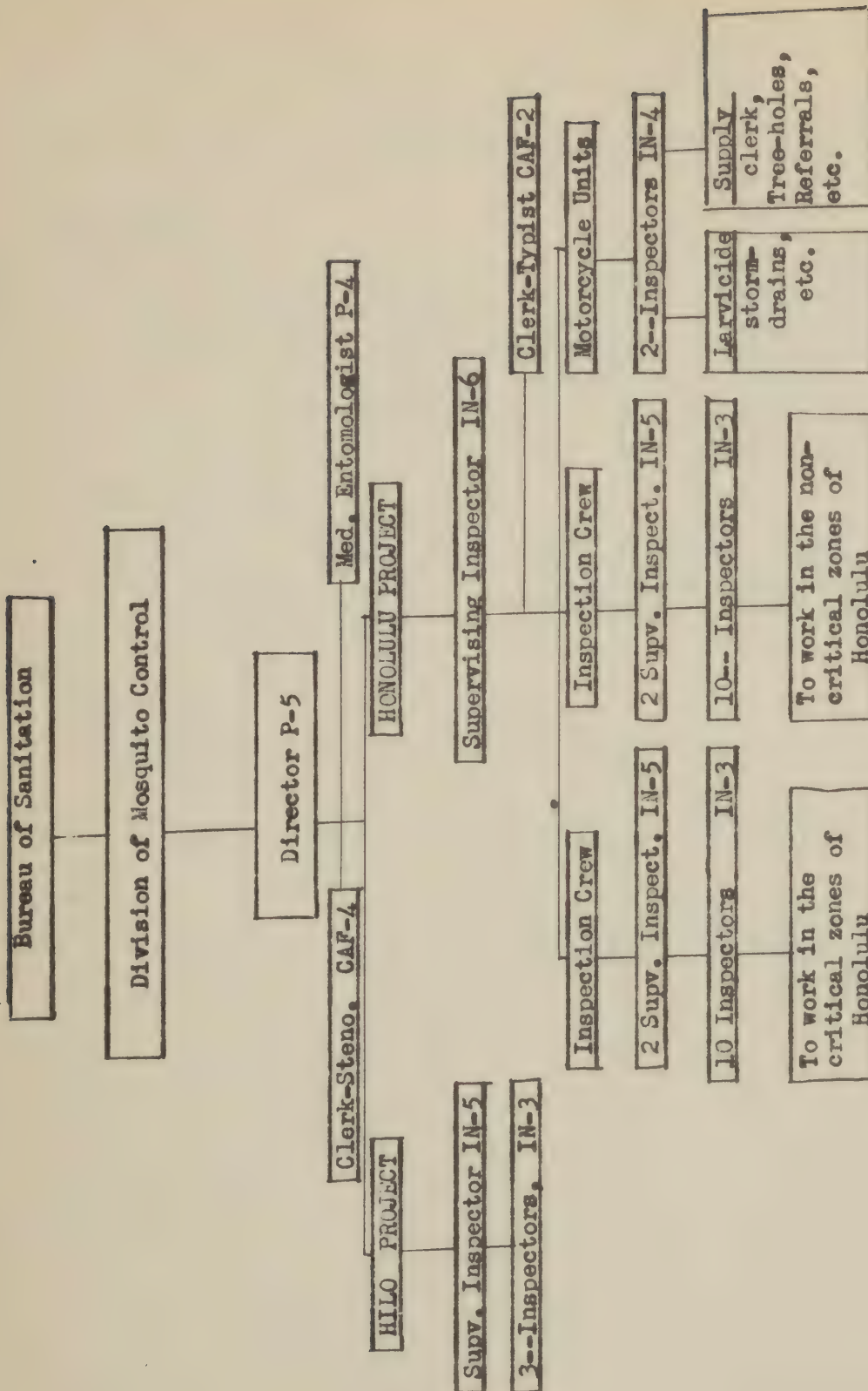
- 2. Normal Plan of Operations: In the city of Honolulu, there are approximately 23,000 premises. An average inspector should be able to inspect about 70 premises per day or the entire city inspected in 330 inspector man days. With five working days per week, 20 inspectors will cover the city of Honolulu on a 3.3 week cycle or every 23 days.

With the development of DDT larvicides, there are indications that use can be made of the residual effects of DDT. Regular control operations of the Dengue Control Program at present include plans to use DDT larvicide applied to all potential and actual breeding places with an automatic dispenser. This dispenser applies a liquid volume of a little less than 1 c.c. with each squirt.

Special emphasis will be placed on the use of adulticides. Present plans call for the continued use of pyrethrum sprays fortified with DDT dispersed by power-spraying equipment. The DDT is added to the water emulsion pyrethrum spray by including an additional amount of emulsifier. This spray is calculated to give a complete adult kill in the areas used as well as complete larval kill by the addition of the DDT.

Regular special services call for two motorcycle units. One unit will be used full time to oil storm-drains, catch-basins, small ditches, and other permanent breeding spots located by the inspectional staff. These potential breeders will be inspected and larvicided on a two-week schedule. When a place is corrected, it will be dropped from the list by the man doing this work. The other unit is provided for the stock-room man who shall handle all supplies, prepare larvicides, have equipment repaired, etc., and when free, assist in abating referral slips, such as filling of tree holes, etc. These two units will do the work of at least 12 inspectors.





Note: Inspection cycles in Hilo and Honolulu will normally be between three and four weeks.





# DIVISION OF MOSQUITO CONTROL

## Biennium Budget Summary

<u>Personnel:</u>	<u>Oahu</u>	<u>Hawaii</u>	<u>Total</u>
First year basic salaries	\$ 79,270.00	\$ 9,780.00	\$ 89,050.00
"    "    salary bonus	15,740.00	2,160.00	17,900.00
Second year basic salaries	83,330.00	10,280.00	93,610.00
"    "    salary bonus	<u>15,740.00</u>	<u>2,160.00</u>	<u>17,900.00</u>
<u>Total Personnel</u>	<u>\$194,080.00</u>	<u>\$24,380.00</u>	<u>\$218,460.00</u>
<u>Other Expenses:</u>			
First year	\$ 15,631.00	\$ 1,792.00	\$ 17,423.00
Second year	<u>15,631.00</u>	<u>1,792.00</u>	<u>17,423.00</u>
<u>Total Other Expenses</u>	<u>\$ 31,262.00</u>	<u>\$ 3,584.00</u>	<u>\$ 34,846.00</u>
<u>Equipment:</u>			
First year	\$ 13,050.00	\$ 1,700.00	\$ 14,750.00
Second year	<u>-----</u>	<u>-----</u>	<u>-----</u>
<u>Total Equipment</u>	<u>\$ 13,050.00</u>	<u>\$ 1,700.00</u>	<u>\$ 14,750.00</u>
Biennium Project Cost:	<u><u>\$238,392.00</u></u>	<u><u>\$29,664.00</u></u>	<u><u>\$268,056.00</u></u>

# BOARD OF HEALTH

## Summary of Proposed New Positions

### Annual Cost Figures (1945 Salary Schedule)

#### "Mosquito Control"

Position	Classification	Symbol	Monthly Rate	Annual Rate	Oahu	Hawaii
<u>Supervisory Personnel:</u>						
Sanitary Engineer	P-5		\$436.67	\$5,240.00	\$5,240.00	
Medical Entomologist	P-4		362.08	4,345.00	4,345.00	
Clerk-Stenographer	CAF-4		174.17	2,090.00	2,090.00	
Sub Total			972.92	11,675.00	11,675.00	
<u>Field Personnel:</u>						
Supervising Mosquito Inspector	IN-6		264.58	3,175.00	3,175.00	
Clerk-Typist	CAF-2		142.50	1,710.00	1,710.00	
Asst. Supervising Mosquito Inspector (5 Positions)	IN-5		237.50	2,850.00	11,400.00	\$ 2,850.00
Mosquito Inspectors (2 Positions)	IN-4		212.92	2,555.00	5,110.00	
Mosquito Inspectors (23 Positions)	IN-3		192.50	2,310.00	46,200.00	6,930.00
Sub Total					67,595.00	9,780.00
Basic Labor Costs					79,270.00	9,780.00
Bonus Addition					15,740.00	2,160.00
Total Basic Labor Costs					\$95,010.00	\$11,940.00



# MOSQUITO CONTROL

## Proposed Budget--For One Year

<u>Other Expenses</u>		<u>Total</u>	<u>Oahu</u>	<u>Hawaii</u>	
0210	Fuel	615.00	540.00	75.00	Kerosene, and diesel oil for spraying
0260	Educational and scientific supplies	3,220.00	2,600.00	620.00	DDT, pyrethrum, solvents.
0270	Stationery & Office supplies	800.00	700.00	100.00	
0290	Other supplies:				
	Engineering supplies	100.00	100.00		
	Mechanics supplies	100.00	100.00		
0300	Building materials	180.00	120.00	60.00	Books shelving, etc.
0390	Other materials	100.00	80.00	20.00	Sand, cement
04	Communication Service	800.00	720.00	80.00	Postage, telephone, radiogram
05	Travel Expenses	3,100.00	3,000.00	100.00	
	Engineer in Charge				(2 annual trips
	or	1,000.00	1,000.00		(to each
	Medical Entomologist				(island
	Staff Hawaii, Supv.	100.00		100.00	One trip to Oahu
	Mobile unit Standby				
	travel for travel to				
	any island	1,000.00	1,000.00		
06	Transportation of				\$400 for Mobile
	things	500.00	475.00	25.00	Unit
07	Printing and Binding	-----			
08	Advertisement	-----			
09	Heat	-----			
10	Rent	-----			
11	Repairs to Machinery	200.00	200.00		Repairs to power
					sprayers
12	Miscellaneous Expense	108.00	96.00	12.00	Car Insurance
13	Upkeep Motor Vehicles	5,400.00	4,800.00	600.00	9 cars in
					operation
Sub-Totals		\$17,423.00	\$15,631.00	\$1,792.00	

Note: These figures doubled for next year.

<u>Equipment</u>	<u>Total</u>	<u>Oahu</u>	<u>Hawaii</u>
3000 Motor Vehicles (New)			
2-Passenger cars	\$3,000.00	\$3,000.00	
4-Pick-up trucks			
(1/2 ton)	6,000.00	4,500.00	\$1,500.00
1-1 1/2 ton truck	2,000.00	2,000.00	
2-Motorcycle Units	1,600.00	1,600.00	
3010 Office Equipment;	1,000.00	800.00	200.00
2 typewriters;			
8 desks & chairs;			
filing cabinets;			
adding machine.			
3080 Engineering instru-			
ments and equipment:	350.00	350.00	
Binocular dis-			
secting microscope.			
2 power sprayers.	800.00	800.00	
Spraying and dusting			
equipment.			
Sub-Totals	<u>\$14,750.00</u>	<u>\$13,050.00</u>	<u>\$1,700.00</u>



Sanitary Aspects of the Control of  
The 1943-1944 Epidemic of Dengue Fever in Honolulu\*

by

Wesley E. Gilbertson, P. A. Engineer (R), F.A.P.H.A.

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\* Presented before the Engineering Section of the American Public Health  
Association at the Seventy-third Annual Meeting, New York, N. Y.,  
October 5, 1944.

Incl. 3

## LIST OF REFERENCES

### Chapter 38

1. Memo EGC to Col King, dtd 2 July 1942, File 211, Sanitary Engineers, 1942.
2. Route Slip, Surg to G-1 and PM, dtd 2 Sept 1942, File 211, Med Insptr.
3. File 1-080, Board of Health (1943) a letter from Dr. Haralson to Gen Emmons with ind by Gov Stainback.
4. Extra copies of GO #122 are available fr File 12-720.7, Garbage Disposal, 1942.
5. Copies of Adm Order Index 700.90, 5 Jan 45.
6. File 31A-710 Plague, 1943 (Ltr of 3 April w/6 paragraphs)
7. File 31A-710 Plague, 1943 (Ltr of 5 April)
8. File 31A-710 Plague, 1943 (Ltr of 26 April)
9. File 31A-710 Plague, 1943 (Ltr to AG, 17 Sept) w/1st Ind.
10. File 4-201 Onstott, Classified, 1944.
11. Hq CPBC, to CG, Hq POA, File (Surg) 350.05, ETMD fr Overseas Forces, dtd 22 Nov 44.
12. Monthly Narrative Reports, U.S. Public Health Service, Dengue Mosquito Control, Board of Health, T. H., Incl. #1.
13. Ltr, Hqs USAFICPA to TAG, US Army, Washington, D. C., File (Surg) 320.3, subj: Special Sanitary Battalion, dtd 1 Jan 44, w/1st Ind thereto dtd 2 Feb 1944.
14. Ltr, Asst Sec'y of War to CG, Hawaiian Dept, dtd 8 July 43, File 10-020 Asst Sec'y of War, Classified, 1943.
15. Ltr Rech to McCloy, dtd 20 July, File 12-020, Asst Sec'y of War, Classified, 1943.
16. Ltr, Rech to McCloy, dtd 6 Sep 43, File 14-020 Asst Sec'y of War, 1943.
17. File 4-201 Onstott, Classified, 1944.



18. Ltr, McCloy to Rech, dtd 7 Oct 43, File 16-020 Asst Sec'y of War, 1944.
19. Ltr Onstott to Surg Gen USPHS, dtd 1 Jan 44 w/9 Incls, File 11-201, Onstott, Classified, 1944.
20. Gen Orders No. 37, Hq USAFPOA, File 300.4, Gen Orders POA.
21. File 725.1, Mosquitoes, Serial No. 38, 1944, HHD, Off of Dept Surg.
22. File 725.1, Mosquitoes, Serial No. 60, Surg Off, CPA, 1944.
23. Incl #2.
24. Incl. #3.
25. File No. 620, Housing of Officers & EM, Serial No. 13, 1944, (2 letters w/1 Incl to 2nd)letter, Surg Off, CPA.
26. File 620, Housing for Officers & EM, 1944 (Holiday House), Serial No. 9, Surg, CPA.
27. Gen Orders #18, Hq POA, 6 Feb 45.





## CHAPTER 39

### Occupational Health (History of Preventive Medicine)

WD Circular No. 59,<sup>1</sup> dated 24 February 1943, established the Industrial Medical Program of the United States Army. It was stated in this circular that "the Army is obligated to furnish safe and hygienic working conditions and to maintain an adequate industrial medical service." Responsibility for making necessary provisions for the supervision of industrial hygiene was delegated to The Surgeon General. An Army Industrial Hygiene Laboratory was founded collaterally at Johns Hopkins University for the purpose of conducting surveys and investigations concerning occupational health hazards in Army-owned industrial facilities. The circular further stated the duties and functions of the Office of The Surgeon General and the Army Industrial Laboratory and established the relationship of the service commands to the Industrial Medical Program. It further provided for a qualified medical officer to act as industrial medical officer and outlined his duties; a qualified Sanitary Corps officer was authorized as assistant. The relationship of the Industrial Medical Program to the Air Forces was given, and the functions of the medical officer or civilian physician, assigned to medical service in Army operated plants were described.

The Industrial Medical Program in Hawaii was instituted in the Hawaiian Department under the Department Surgeon, on or about 30 March 1943. An Industrial Hygiene Engineer and an Industrial Medical Officer were appointed.<sup>2</sup> These officers drew up an outline of a tentative program for Industrial Hygiene and submitted it to the Assistant Department Surgeon, on 19 April 1943.<sup>3</sup> This tentative program was subsequently approved by the Chief of Staff. A proposed department circular, subject, "Industrial Medical Program in the Hawaiian Department"<sup>4</sup> was prepared by the Industrial Hygiene Engineer and was submitted to the Chief of Staff, Hawaiian Department Service Forces, for approval. The proposed circular was in effect, a condensation of WD Circular 59, dated 24 February 1943. Contents of the proposed circular were subsequently published in the form of a letter to Commanding General, 7th Air Force; Department Chemical Officer; Department Engineer; Department Ordnance Officer; Department Quartermaster; Training and Security Officer; and Department Surgeon, on 20 July 1943.

In the meantime the Industrial Hygiene Engineer conferred<sup>5</sup> personally with commanding officers of Department agencies. Letters were written to the commanding officers of these agencies requesting information on operations involving possible health hazards. Replies made to these letters formed the basis for subsequent investigations by the Industrial Hygiene Engineer.

In the course of their work on the industrial hygiene program, the Industrial Hygiene Engineer and the Industrial Medical Officer contacted the Territorial Board of Health in Honolulu, T.H., where a program of Industrial Hygiene was already in effect.<sup>6</sup> They found that the Board of Health was equipped with the necessary field instruments, a laboratory and a staff consisting of a Sanitary Engineer, and two chemists, both of whom were of Japanese ancestry.

Prior to this time, the Department Surgeon formed a Sanitary Detachment, attached to the Department Surgeon's Office, for the purpose of assisting the Board of Health in carrying out sanitary inspections of restaurants, housing, dairies, etc. A training school, known as the Hawaiian Department Sanitation School, was held at the 147th General Hospital which was then located on the campus of St. Louis College, Honolulu, T. H. Army medical officers and civilian health authorities conducted classes at the school. Field trips were taken by the detachment under the auspices of members of the Board of Health. Men in this school were to be allotted to various Bureaus of the Board of Health to reduce the manpower shortage. The Industrial Hygiene Bureau was interested in getting a man, preferably a chemist, who could assist in investigations of industrial hygiene problems for the Army. The U. S. Engineering Department had requested assistance from this Bureau in detecting and controlling health hazards in construction work. Since the two field assistants were of Japanese ancestry, they were not permitted on Army posts. Therefore, the Bureau needed an Army man who could carry out the field tests and have access to restricted areas. An enlisted man was assigned on 12 September 1942 to the Board of Health to work in the industrial hygiene section. All work in industrial hygiene for the Hawaiian Department was then done by the Territory Board of Health until July, 1943.<sup>7</sup>

During this period, September, 1942 - July 1943, there was no official liaison between the Board of Health and the Hawaiian Department. What work was done for the Army, was done at the personal request of the Safety Engineer for United States Engineering Department. Arrangements were made with the Board of Health to have tests and samples analyzed on the various jobs. Generally, the Army technician accompanied the Safety Director to the location of the job and made the tests. If there was evidence of potential poisoning, corrections were made immediately by authority of the Safety Engineer. At that time there was considerable tunneling being done on the island. This was hard rock mining and all the health hazards associated with hard rock mining, such as dust, carbon monoxide, and nitrogen oxides were to be found. The work was done under considerable pressure. Many jobs were started without provisions for adequate ventilation. There was not enough equipment on hand to provide blowers and ducts for every tunnel and there were cases of asphyxiation.

In some instances although tests showed a positive health hazard there was no way in which to eliminate the hazard due to the



lack of equipment. Every effort was made, however, by the Safety Engineer to provide safe working conditions. But, as stated before, the great pressure for defensive construction made it necessary to do without protective equipment.

One of the most trying and difficult problems at the time was the lack of good drinking water at the various construction jobs. Many tests were made in the laboratory to determine the B-Coli count. In all such tests water could not be considered potable. Water was often hauled in by trucks for many miles and was distributed to the men by means of wooden barrels. Generally the common dipper was used. Although no official report was made of these investigations, results of the surveys were written and are on file at the Territorial Board of Health. Several written reports of these tunnel surveys, however, are to be found in the Industrial Medicine Report, File No. 729.3 Hq Hawaiian Department, Office of the Department Surgeon for 1943. These reports were made after the Industrial Hygiene program was formally established.

Formal reports, however, do not give a complete picture of the hard, dangerous work which was performed by the men in these tunnels. One must see men working on a high scaffold at the face of a tunnel where the temperature is considerably elevated and the noise is almost unbearable, with carbon monoxide and silica dust in the atmosphere to provide a final threat, in order to understand the purpose and need for Industrial Hygiene.

In these early days of the war, it was not uncommon to hear the remark "This is war; we expect to lose men." Under the circumstances, it was easy to pass off responsibility for providing safe working conditions.

Real support for the Industrial Hygiene program in the early days, however, came from the construction bosses who were well aware of the hazards of their work and who actively supported practical measures for improving working conditions. A fine spirit of cooperation developed between the Industrial Hygiene Inspector, the Safety Engineer and the men as a result of the continual effort to improve working conditions. Although working conditions in the tunnels were never developed to the standard desired, the efforts did result in some improvement. Better water was obtained; better mess facilities were constructed; ventilation was looked after carefully. There were lapses in good practice of course, due to the pressure for results. Unfortunately, the main volume of tunnel construction was completed before any extensive and integrated program of Industrial Hygiene could be instituted. It seems evident in retrospect that Industrial Hygiene should be on the job continually. A back-log of experience and organization to meet situations of this kind is necessary and constitutes a vital portion of medical service.

A more successful undertaking, however, was made in the surveys of the camouflage plants. There were two plants in the Central Pacific Area manufacturing camouflage garlands, and the attention of Industrial Hygiene Inspector of the Board of Health was drawn to these plants by the Safety Engineer, U.S.E.D., because of the large number of women involved. Camouflage in those days was manufactured in considerable quantities, although primitive methods were employed. The prepared paint was dumped into bath tubs, into which the women dipped the untreated burlap with their bare hands. They then put the burlap through wringers to remove excess paint. Women were suffering from dermatitis and production was limited.

Efforts were then made to solve the production problem and to eliminate health hazards. One of the plant's supervisors took an active part in this problem, and on encouragement from Safety Branch, and Industrial Hygiene Inspector, developed a paint bath and a mechanical cutter which increased production tremendously and eliminated almost entirely the handling of material by hand. It was a notable accomplishment. Pictures were taken to show the improvements and at a later date, a report was submitted to the Essential Technical Medical Data.<sup>8</sup>

Other investigations were made as listed in the Industrial Hygiene Program summary from January, 1939 to July, 1943.<sup>9</sup> Improvements certainly were made. They were made as a result of demonstrative tests showing that a health hazard actually existed. The accomplishments took time, but were nevertheless effective in spite of handicaps from the lack of official status in the Army.

In the spring of 1943, when the Industrial Hygiene Engineer and the Industrial Medical Officer were developing the Industrial Hygiene Program for the Hawaiian Department, they found the situation at the Territorial Board of Health readily adaptable to their plans. Arrangements were made informally with the Director of the Territorial Board of Health, to incorporate certain activities of the Industrial Hygiene Branch of the Board of Health into the Industrial Medical Program in the Hawaiian Department.

A new officer<sup>10</sup> was designated Industrial Hygiene Engineer for the Hawaiian Department.<sup>11</sup> Permission to use the laboratory and instruments of the Territorial Board of Health was granted informally to the Department Surgeon. A history of Industrial Hygiene activities involving Army agencies in the Hawaiian Department from January, 1939 to July, 1943, the beginning of the Industrial Medical Program, was prepared by the newly appointed Industrial Hygiene Engineer.<sup>12</sup>

After the beginning of the formal Industrial Medical Program in the Central Pacific Area, a formal and organized approach was made



to the problem. There was considerable staff support. The ground work with the various agencies had been laid and it was only a question of which agency would be studied; it was decided to survey Chemical Warfare Service activities at Schofield Barracks first. The Industrial Hygiene Engineer and the Industrial Medical Officer conferred with Chemical Warfare Service Officers at Schofield Barracks and plans were made to carry out a survey of the impregnation plants. At that time, a very strict blackout was maintained on all Army posts. The impregnation plants were using tetrachlorethane as a solvent in the impregnation of clothing against war gases. A very brief survey of conditions seemed to warrant a more thorough study of these plants. Actually, little was known, at that time, about tetrachlorethane and the probable effects on the workmen, and no one seemed to be familiar with the actual potential health hazards. It was necessary to study plant operations and to study the literature on tetrachlorethane. The more information obtained, the more serious the problem appeared. There was some provision for ventilation in the plants, but it was found that the concentration of tetrachlorethane was well above the probable safe limit. A considerable body of information was assembled from chemical tests and from reports in the literature.

As a result of this survey, chemical warfare service officers supported the plan to revamp and develop the ventilation system. The aid of the Engineer's Office, then known as the U. S. Engineering Department, was enlisted. A personal visit was made to the Engineer's Office by the Industrial Hygiene Engineer for the purpose of meeting the parties responsible for construction. At the time it seemed necessary to contact the Construction Branch in order to find out how to handle matters involving construction for a third party. It was indeed a very fruitful visit. The Industrial Hygiene Engineer finally met the engineer who was in charge of the building sub-division. A general discussion of the Industrial Medical Program was held, and the engineer was informed of the tentative program in view. The engineer, apparently sensing that such a program would involve considerable construction work and would put an additional burden on the already over-worked Engineering Department, was not very enthusiastic. He wanted to know who was going to back up the program. He was reminded that the Surgeon, C.P.A., was actively supporting the program, and apparently he decided that the Industrial Medical Program was to be reckoned with, for from that time on, the Engineer's Office gave the Industrial Medical Program its whole-hearted support.

Probably the greatest single factor in the success of the Industrial Medical Program in Hawaii was this close cooperation between the Surgeon's Office and the Engineer's Office. Too great an emphasis on the proper liaison between the Surgeon's Office and such a vital agent as the Engineer's Office cannot be given. Most industrial hygiene problems involve features which are too involved for one man to handle.

For instance, a man with chemical training, who is able to make tests with laboratory instruments is not likely to be an expert on the proper type of motors for a ventilation system, and is less likely to know the situation concerning supply. And, if results are to be obtained, close liaison must be maintained between the agencies involved.

As stated before, preliminary studies and tests were made at the Chemical Warfare Service plants. When it was decided that a basis for definite recommendations was established, a meeting was called by the Industrial Hygiene Engineer of all the interested parties including the Commanding Officer of the Chemical Processing Company, and a representative of the Engineer's Office. At this meeting the problem was discussed and definite proposals were made for construction of additional ventilation facilities, for rearrangement of machinery, and work hours and other problems associated with revamping of a going plant.

The Industrial Hygiene Engineer prepared several reports<sup>13</sup> with pertinent information and with definite recommendations for improving working conditions. The reports included a sketch of the proposed ventilation system and was forwarded to the Engineer's Office. The Engineer's Office further studied the problem from the standpoint of construction, and then drew up detailed drawings for construction. The work was given high priority and the work order was issued.

While these matters were taking place, another aspect of the job was undertaken. Routine medical examinations and laboratory tests were provided for all employees in these impregnation plants.<sup>14</sup> There was continual study of this problem and adjustments and improvements were made from time to time. A review of the efforts to reduce the health hazards in these impregnation plants is given in a paper published in the Essential Technical Medical Data in 1944.<sup>15</sup> The whole matter was a good example of a major problem in Industrial Hygiene, of well established liaison between the various services, of very constructive results and of the judicious use of medical supervision.

A number of other surveys were undertaken during the year 1944. A complete summary of Industrial Hygiene activities for 1944, is given in the Industrial Hygiene file 729.3 for 1944.<sup>16</sup> As stated in paragraph 1b of this report, Industrial Hygiene activities from 1 January 1943 to 31 December, 1944, included complete surveys of nineteen Army plants, eighteen special projects requiring field tests or laboratory analyses, and nine special assignments including two lectures and three written articles for Essential Technical Medical Data. Inspections of eleven completed industrial hygiene construction projects were made with the Medical Inspector, CPBC. Arrangements were made for periodic x-rays, physical examinations and laboratory tests of personnel in more hazardous occupations. Paragraph 1c of this report states that industrial hygiene problems of the CPBC were varied



and included ventilation, lighting, dust control, elimination of toxic gases and fumes, prevention of dermatitis and the introduction of protective clothing. A considerable amount of money was involved in the construction of ventilation systems, sanitary facilities, new protective equipment, and other measures for promoting good working conditions.

This general resume of Industrial Hygiene activities for the year, 1944, is given in more detail in the aforementioned report of activities. A glance at this report will show the wide scope of activities, the variety of problems encountered at different Army agencies, and demonstrates the range of beneficial effects that a well supported Industrial Hygiene Program may have. In this list of activities, may be found occupational hazards involving Quartermaster laundries, Chemical Warfare Service impregnation plants, Army printing plants, Ordnance shops, underground installations, hot plants, bakeries, a laboratory and a theatre.

In each case, it was necessary for the Industrial Hygiene Engineer to establish liaison through proper channels and to study the general layout or process in an effort to obtain a complete picture of the situation. This was generally spoken of as a preliminary survey and took only a matter of hours. Later on, instruments were brought into the plant or office to check up and determine the extent of the hazards or deficiencies. When the tests were completed and the data compiled which indicated that improvements were necessary, a written report was submitted to the Surgeon, Central Pacific Base Command, with recommendations for improvements. This report was accompanied by a route slip by which the basic communication, if approved by the Surgeon, was transmitted to the appropriate staff section and subsequently to the major echelons concerned. In this way, the report was given official recognition. Generally, the required or recommended construction involving \$500.00 or more. In such cases, the report was transmitted to the Engineer's Office for comment and necessary action.

Invariably liaison between interested parties was so well established that no misunderstanding or adverse criticism arose, and usually the drawings and work orders for such projects were issued promptly. It was customary for the Industrial Hygiene Engineer to follow up each project until finally completed.

In order to record the progress on these various projects, and to show definitely what was accomplished, pictorial records of each job were made for the Industrial Hygiene section by Signal Corps photographers. A picture of a projected piece of construction was made before new construction was begun, and later a picture was taken of the completed job. Generally, these pictures were attached to reports which were submitted to the Surgeon.

In the case of the camouflage plant, the services of the Signal Corps were enlisted to make a colorful motion picture of opera-

tions in the manufacture of garlands. Colored motion pictures were taken of the processes before and after improvements were made, and they produced a striking contrast. These motion pictures were used for some time as a part of an illustrated lecture on Industrial Hygiene and were later sent to Washington, D. C., for review. They were not returned to this theater.

For additional information concerning the surveys reported in the summary of activities for 1944, reference is made to the Industrial Hygiene file No. 729.3 Surgeon's Office, Hq, CPA, 1944.

Incidentally, it should be noted that the length of the written reports submitted to the Surgeon progressively decreased. Reports which were written in late 1943 and early 1944 often amounted to fifteen pages of single spaced type, but those reports submitted in 1945 generally averaged a page or two. Keeping a diary on a weekly or monthly basis was another very important part of administrative work in Industrial Hygiene. Since these records were kept, there was little difficulty in compiling a yearly report or a resume of activities when they were required.

In the Medical Inspector's Office, weekly reports of activities were consolidated, and reports on venereal disease, epidemiology, sanitary engineering, industrial hygiene, and so forth, were all kept in the files of the Medical Inspector's Office. It was found to be convenient, however, to maintain a file copy of Industrial Hygiene activities separately for reference.

The objective of the long-winded reports which were submitted in 1943 and 1944 was to develop complete information as a basis for recommendation in construction or alteration. In those early days of the new fledged program, it was considered necessary to make the basis for recommendations air-tight and completely documented with evidence. The idea was to impress the Surgeon, the Engineer and the echelon commander with the need for improvement. This was probably worth while, except that no one read such long reports carefully, and it was found that the same objective could be obtained by a concise statement of the particular problem, the results of the test, and any other necessary pertinent remarks, together with the recommendations. When all this information could be reduced to one page, the report was read, and it was not necessary to furnish tables of results, graphs, and plant layouts as was done earlier. However, the scientific basis for recommendations, i.e., the detection and the determination of the extent of the hazards, was always carried out. In this way, a reputation for accuracy and soundness was maintained, and there was little danger of the Industrial Hygiene Program being discredited on such a basis.

From time to time reports were submitted to the Essential Medical Technical data on various Industrial Hygiene projects. These



reports entailed extra effort in rewriting reports, but the effort was rewarded. Recognition of Industrial Hygiene activities in the Central Pacific Area was given by The Surgeon General's Office,<sup>17</sup> and needless to say, this encouragement was highly valued. Only a few of the various Industrial Hygiene projects were reported in Essential Technical Medical Data, and those selected were intended to show the scope of activity and the kind of results that were obtained.

It was keenly satisfying to the staff in the Industrial Hygiene Section to see these reports published. The only other published report of Industrial Hygiene activities to our knowledge was a very interesting paper on laboratory procedure and field tests concerning dimethyl phthalate from the South West Pacific Command.

Reports of Industrial Hygiene activities were expected with interest from other theaters, but if these reports were published, they never came to the attention of the staff in this theater. It was considered regrettable that a more active exchange of ideas in this field during the war was not carried out.

Another activity which was undertaken by the Industrial Hygiene staff for the purpose of educating various groups interested in Industrial Hygiene was lecturing. An illustrated lecture on Industrial Hygiene was prepared by the Industrial Hygiene Engineer and was given upon request. This lecture was given to the foremen and superintendents of the South Sector Engineer Repair Depot; to the Safety Superintendents of the Engineer's Office; to Officer's Candidate School at Schofield Barracks; and to Safety Officers of the Office of Civilian Affairs.

Dermatitis was a recurrent problem at the South Sector Engineer Repair Depot, and at the request of the Safety Engineer, a lecture was given by the Industrial Hygiene Engineer on the prevention of dermatitis. These lectures, which brought the matter of Industrial Hygiene directly to the man at the working bench, were considered very valuable from the educational standpoint. This particular organization, the South Sector Engineer Repair Depot, was a large, well organized group of men who were engaged in maintenance and repair of heavy duty machinery of all types, automobile repair, machine shop work, and fabrication of equipment. An active safety campaign had been carried on in the base yard. A well organized bond drive had been undertaken. And in such a group ideas which were pertinent to the work at hand were intelligently received. It was emphasized in the lecture to these men that production was very important to the war effort and it was pointed out that lost time accidents, occupational diseases, and absenteeism were hampering production in the war effort. Emphasis was laid on that particular plant as being important in the war effort and pride in their work was stimulated. From the lecturer's standpoint it was easy to see the response of these men when they were considered as soldiers on the production line.

It may be stretching the point to say that this type of activity is Industrial Hygiene, but actually, there was comparatively little effort expended on information-education and morale for factory workers in this theater. Although, too wide a variety of activities may tend to limit Industrial Hygiene accomplishment, this particular activity was considered essential by the Industrial Hygiene staff in this theater, and should be incorporated, it is felt, in all Industrial Hygiene work. An Industrial Hygiene Engineer has a rare opportunity to contact men in the plant, and as an expert on working conditions, and as an officer in the Army, he speaks with considerable influence on civilian workers. But, of course, lecturing is no substitute for practical construction and the elimination of health hazards. But, in its place, it is felt that this activity serves a very useful purpose.

The arrangements for medical examinations for workers inevitably becomes a part of Industrial Hygiene Service. When it was discovered that men were working in a potentially dangerous occupation, action was taken to have the men given medical supervision before clinical symptoms of disease appeared. In the case of service personnel working in the Chemical Warfare Service impregnation plants, the whole company was given physical examinations and laboratory tests routinely. This entailed special arrangements; in fact, a project was made of this work. Records were kept and men were relieved from duty whenever there was any indication of poisoning.

In setting up such a medical program, it was found that it was sound policy for the Industrial Hygiene Engineer, through the Surgeon, to outline the tests and examinations to be given and to state what records were to be kept, and how often men were to be examined, so that complete and detailed information was recorded. From time to time it was found that tests and procedures needed modifications, and such modifications were requested in writing. If a hospital or laboratory, which happens to be doing the tests and physical examinations, is suddenly moved, as was the case in this theater, records and information can easily be transferred to a new unit.

The Industrial Hygiene Engineer must take it upon himself to see that the proper directions are given and that sufficient records are kept to make the program satisfactory. It was easy to make arrangements to have x-rays, blood tests, and physical examinations done on plant workers by proper request through military channels.

At this point, a few words are ventured concerning the place of the Industrial Hygiene Engineer in the organization of the Army. In the Central Pacific Area, the Industrial Hygiene Engineer was attached to the Surgeon's Office, Headquarters, and he functioned as a part of the Medical Inspector's Office. This arrangement, it is felt, was ideal for the accomplishment of the Industrial Hygiene Program. The



Industrial Hygiene Program fits in very well with the duties of the Medical Inspector's Office. Attached to Headquarters, the Industrial Hygiene Engineer is given the necessary support to deal with other echelons. Being on the staff of the Surgeon, enables him to balance field work with necessary medical advice, and the clerical staff of the headquarters provides excellent assistance in drawing up records and reports.

Of course, the active and interested support of the Surgeon and the Medical Inspector cannot be over estimated. Such support is felt by the Industrial Hygiene Engineer in every day of his work. The Industrial Hygiene section of the Medical Inspector's office functioned under three different Surgeons during the war. In all respects, the Surgeons gave sympathetic and active support to the program.

When the Industrial Hygiene Engineer in the Central Pacific Area found it necessary to start a survey of a major echelon such as Ordnance Service or Quartermaster Service for the first time, the Medical Inspector of the Central Pacific Area, with the full support of the Surgeon, would accompany the Industrial Hygiene Engineer on a visit to the Commanding Officer of that particular echelon. A pre-arranged conference would be held then with the Commanding Officer. Facts on the Industrial Medical Program would be presented to the Commanding Officer and the purpose of the intended surveys would be outlined. Pictorial matter concerning previous surveys would be shown and a request would be made for a written letter introducing the Industrial Hygiene Engineer and stating to plant officers the purpose of the proposed visit. This letter was always supplied upon request and fulfilled a very useful purpose. A letter from the Commanding Officer of a major echelon to a plant officer carries invaluable support. Although, this method of doing business may smack of high pressure salesmanship, it was considered strictly within bounds of military courtesy and operation. Certainly, personal contact with the Commanding Officer of the service and the knowledge on his part of the survey were desirable, for when reports were later submitted to his office, the Commanding Officer was already fully informed. Utilization of proper channels was found to be important to the Industrial Hygiene Engineer and was made standard operating procedure.

During the year 1944, Industrial Hygiene activities expanded considerably and additional personnel were added to the staff. Very shortly after the Industrial Hygiene Program was begun, a search was undertaken for a qualified service man whose duty it would be to assist the Industrial Hygiene Engineer. A private, U. S. Army, was selected from a replacement depot on the basis of personnel records. He was a graduate chemist but had no practical field experience in chemical engineering or in industrial hygiene. During his assignment, however, he rendered valuable service in the laboratory and in the field.

During 1944, another service man was added to the staff. He was also a young graduate chemist without practical industrial experience. It was necessary to teach these men the use of the various instruments used in industrial hygiene, and to supervise their work in the laboratory. They were encouraged to study and to develop their own ideas, and both men were promoted during their tour of duty.

It is suggested here that the most important asset of the Industrial Hygiene Engineer in addition to his technical training and personal assets is his practical industrial experience. The man who has worked in various industries will find this experience most helpful. He will have the feel of the factory. And with this background of practical industrial experience he will be able to meet and work with experienced plant superintendents who are notoriously hard-headed individuals. The civilian plant superintendent who works for the Army generally considers military supervision and inspection as unnecessary interference, and either resents or attempts to side step any effort to change conditions within his plant. But it was the experience of the Industrial Hygiene Engineer in the Central Pacific Area that a demonstration of constructive effort was the best insurance for further cooperation and further improvement.

With the addition of two men to the staff of the Industrial Hygiene Section and with the increasing number of projects under study, the facilities at the Board of Health became overburdened. There was only one set of instruments available and these instruments were shared by five operators. There was only one-half of a laboratory bench available and this also was shared by five people.

For some time the possibility of establishing an Army Industrial Laboratory in this theater had been under consideration. An itemized account of necessary instruments and laboratory equipment was made. Part of the hospital laboratory of the 218th General Hospital was made available to the Industrial Hygiene section. A list of instruments and books required for Industrial Hygiene work was transmitted through the supply office of the Surgeon's Office to The Surgeon General's Office for approval and purchase. In reply, The Surgeon General's Office sent information concerning Industrial Hygiene instruments which were available in field chests. In general, the contents of these chests were similar to the instruments requested and the written request was then changed to conform with the suggestions of The Surgeon General's Office. In due time the two field chests arrived in the Central Pacific Area and were found to contain all necessary field instruments and some additional equipment useful in laboratory experiments. It was evident that careful consideration had been given to the assembly of these chests. The Industrial Hygiene Section was then able to establish its own laboratory and the arrangement with the Board of Health was terminated in September, 1944.



On 20 May 1944, War Department Circular No. 198<sup>18</sup> was published, subject: Industrial Medical Program of U. S. Army. This circular was similar in most parts to WD Circular No. 59, but contained additional directions concerning personnel, supplies and other matters.

From the first of the year, 1945, until the end of the war, Industrial Hygiene surveys and activities were continued. A record of these activities is contained in the Industrial Hygiene File No. 729.3 Surgeon's Office, Hq, CPBC, for 1945.

Among the surveys during this period were a number of Ordnance plant surveys which involved such interesting problems as ventilation of a test firing range, ventilation of dust proof carburetor rooms, improvements in illumination, ventilation of metal treating plants, and dust collection units for lumber shops. Considerable time and effort was expended on providing ventilation in connection with trichlorethylene degreasing tanks which were installed at Ordnance, Signal and Engineer Plants when trichlorethylene became available in this theater. Provisions were not made at the time for eliminating fumes. Construction of ventilating systems was undertaken promptly but had not yet been completed at the end of the war. With the rapid favorable progress of the war in this area, the disadvantages of blackout were particularly obvious to the Industrial Hygiene Engineer, and his recommendations for modification and removal of blackout from shops was submitted at the earliest feasible date.

Of particular interest at this time was a board of inquiry which made an investigation of working conditions in Chemical Warfare Service impregnation plants.

As stated earlier in this report considerable work was done by the Industrial Hygiene staff at the impregnation plants of the Chemical Warfare Service. These plants had been in operation, however, before the Industrial Hygiene Engineer and his staff were on the job. As a result of the Industrial Hygiene survey, considerable remodeling and new construction of ventilation facilities were undertaken. The improvements in plant ventilation were considered satisfactory and adequate, and the Industrial Medical Program of physical examinations and laboratory tests was considered an effective preventive measure. Nevertheless a formal complaint was made to the Inspector General's Office by one or more of the service men employed in these plants, and the Commanding General, CPBC, ordered an investigation. Three Chemical Warfare Service officers in this theater were appointed to the Board of Officers. Testimony was taken from personnel who had been involved in plant operations, in the physical examinations and tests, and in administrative procedures. The investigation was extensive and the information obtained comprised a thick volume.<sup>19</sup> Results of this investigation were primarily concerned with procedures involving personnel records of men employed in plants. The extent of this investigation involving members of a hospital staff, a general

laboratory, company officers and men of the Chemical Warfare Service, the Industrial Hygiene staff, and a chaplain, indicates the potentialities involved in hazardous working conditions.

Another aspect of the Industrial Hygiene Program developed early in 1945, with the establishment of a safety program for civilian employees of Army agencies. The Safety Officer for the Office of Civilian personnel, called at the Surgeon's Office to establish liaison with the Industrial Hygiene staff and to present a copy of the proposed Administrative Order No. 1, subject: Safety Program for Civilian Employees of Army Agencies. This Administrative Order was published on 26 March 1945. The Safety Officer for the Office of Civilian Personnel, was interested in safety in Army plants and depots where civilian workers were employed. In very nearly all the plants in the Central Pacific Area civilians as well as military personnel were employed, and consequently, the safety program of the Office of Civilian Affairs and the Industrial Medical Program somewhat overlapped. But as it developed, the Safety Officer was concerned with those particular safety hazards such as trip hazards, unguarded openings, falling objects, projection hazards and a number of other unsafe practices which are found in every plant.

The Safety Officer was very active in attempting to promote the safety program. If he found conditions in any particular plant, which he had surveyed, which he thought involved health hazards, he notified the Industrial Hygiene Officer. Thus, the two programs were complementary. When the Safety Officer undertook a survey on the Island of Hawaii, he proposed that the Industrial Hygiene Engineer accompany him. Other members of the inspecting party included the Field Director, Training Branch, Office of Civilian Personnel and the Deputy Commissioner, U. S. Employees Compensation Commission. The party spent five days on Hawaii inspecting construction jobs and plants. This joint investigation worked very well. The Safety Officer was concerned with the immediate hazards to safety and he was able to correct many of them on the spot. The Industrial Hygiene Engineer on the other hand was concerned with those problems of a more involved nature. For instance, the Industrial Hygiene Engineer spent considerable time inspecting the insect control facilities and fumigation facilities.

Among other things which came to the attention of Industrial Hygiene Engineer was the matter of preemployment physical examinations for civilian workers. It was found in many cases that Form 2413, Certificate of Physical Examination, which is required by the Civil Service, was frequently not completely filled out, and that these examinations were done by local civilian physicians. The matter seemed to warrant further study. Very shortly after the parties' return to Oahu, Circular No. 155<sup>20</sup> came to the attention of the Industrial Engineer. Circular No. 155 stated that "at installations having an industrial medical program established in accordance with WD Circular No. 198, 1944, the Civil Service Commission has agreed



that the determination as to the physical qualifications of an applicant for civilian employment may be made by the appropriate medical officer subject to instructions explained in the following paragraph." It further stated that "where industrial medical officers are so designated, they will act for the Civil Service Commission in approving and disapproving the physical qualifications of persons, both veterans and non-veterans certified by the Civil Service regional office or by the local board, who are considered for appointment to civilian position." It was directed that War Department AGO Form No. 8-179, would be used by all industrial medical officers to record the examination. This circular was timely indeed. A conference had been held with the Manager of Civil Service Branch Office in the Territory, and it was learned that physical examinations had been required by Civil Service in the past but that at the present time the appointing officer had been delegated authority to judge the physical fitness of a candidate. The matter was also taken up with the Officer in Charge, Office of Civilian Personnel, CPBC. It was decided as a result of these conferences that a survey of all employing agencies of Central Pacific Base Command would be made by the Industrial Hygiene Officer. The result of this survey showed that uniform procedures were not used by all the agencies employing civilians. All prospective civilian employees were not given a physical examination. Some were examined by civilian physicians; others by Army medical officers. About half of the civilian employees had been given a blood Wassermann test and a chest x-ray. Since many civilian workers would probably become permanent employees of the Army, it was considered an opportune time to establish a thorough-going program for preemployment examination. A proposed annex to Administrative Order No. 1, subject: Preemployment Examinations for Civilian Employees of United States Army, was drawn up by the Industrial Hygiene Officer and submitted to the Surgeon. A memorandum containing pertinent facts which were discovered during the survey was attached. The proposed annex to the Administrative Order No. 1 contained the following general consideration:

1. That all prospective employees would be given a preemployment physical examination by a Medical Officer in government service.
2. That all prospective employees would use Form No. 2413 or WD, AGO Form 8-179 for the examination.
3. That in addition to the tests listed on these forms, all civilian employees would be given a blood test, and a chest x-ray.
4. That present employees would also be given chest x-ray, and blood test in case these examinations had not been done.

5. That facilities of U. S. Army hospitals and the Territorial Board of Health be used by Medical Officers for laboratory tests.

This matter of preemployment examination for civilians was still under consideration at the time Japan surrendered.

The end of the war with Japan found many industrial hygiene projects still under construction and requests continued to be made for industrial hygiene services. The comparatively short time in which the Industrial Hygiene Program functioned limited to some extent the scope of activity. It was necessary, as late as 30 March 1943, to begin laying the ground work for this program. Considering the importance of industry in modern warfare and the direct influence which industrial hygiene has on production through maintaining good working conditions, it is hoped that War Department authorities will continue to recognize the usefulness and effectiveness of this type of work, and will provide a working basis for continuation of this type of work in the Army. It is quite likely that benefits would be derived from a continuous development of the Industrial Medical Program.



HEADQUARTERS HAWAIIAN DEPARTMENT  
OFFICE OF THE DEPARTMENT SURGEON

In reply refer to:  
(MED) 729.3

Fort Shafter, T. H.  
28 July 1943.

Subject: Industrial Hygiene Program in Hawaii from January 1939-July 1943.

To: The Department Surgeon.

1. The history of industrial hygiene in Hawaii began about 1 January 1939 when preliminary surveys of local industries were made under the direction of Mr. F. A. Schramm, Senior Sanitary Engineer, Territorial Board of Health, to determine the need for this service. Results of the survey revealed that approximately 10,000 workers in Honolulu were engaged in occupations where there was a potential health hazard. Inclosure No. 1 lists the number of workers exposed to each specific chemical in use.

a. Support for the proposed program was readily obtained from insurance companies and industries in the Territory. When the need for the industrial hygiene program in Hawaii had been demonstrated to the United States Public Health Service, expenditure of Public Health Service funds for the work was authorized. The Industrial Hygiene Section was then included in the organization of the Territorial Board of Health, Bureau of Sanitation. Laboratory facilities and special instruments for the detection and determination of industrial poisons were provided as well as books and magazines pertaining to the work. Technically trained personnel were employed.

b. The organization of the program being completed, detailed studies of industrial hygiene problems were begun in cooperation with local industry. The studies included the collection of representative samples of gases, fumes, and dusts contaminating working atmospheres, analysis of various materials in use, and a chemical determination of the extent of the hazard involved. Information concerning ventilation, light, humidity, noise, and temperature changes were included where they affected the problem. When exact data on the nature and extent of the hazard were obtained, a report was written of the study in accordance with the form attached as Inclosure No. 2.

2. Effect of the outbreak of war on the Territorial Board of Health Program.

Incl. 1

a. Needless to say, the outbreak of war increased the demands on public health services. Request for assistance in protecting plant manpower became urgent due to speed-up in production. It was expected that workers would be victims of industrial poisons in greater numbers, that new employees would be ignorant or careless of potential hazards, that new processes and techniques would create problems concerning health, but the very outlook was a challenge to industrial hygiene methods in protecting workers on vital war projects.

b. Unfortunately the outbreak of war in Hawaii limited the scope of activities in industrial hygiene at the Board of Health for a time because the two industrial hygiene chemists, who were of Japanese ancestry, were not permitted to enter on war projects. The Board of Health then requested the Army to provide personnel to aid in carrying on the work in industrial hygiene and other public health services.

3. Joint effort of Army and Territorial Board of Health in maintaining Industrial Hygiene Program, begun 12 September 1942.

a. The Army cooperated in meeting the request of the Territorial Board of Health for additional personnel by assigning enlisted men from the Department Surgeon's Office to work on detached service with the Board of Health. Among these personnel was Tech. 4th Grade W. C. Mawhinney who was assigned to work in the laboratory and in the field on industrial hygiene problems.

b. The U.S.E.D., with many problems in industrial hygiene and safety to cope with as a result of rapid expansion, called on the Board of Health for assistance because the laboratory, the necessary instruments and the trained personnel necessary, were available. A basis of technical data for the control of potential industrial hazards was established for work in tunnels, paint shops, camouflage plants, printing plants, etc.

c. The Army made use of this industrial hygiene service during an emergency at Fort Kamehameha Ice Plant.

d. The Navy, while developing its own program, frequently used the facilities at the Board of Health.

4. Summary of industrial hygiene surveys on war projects including the hazards found (Jan 1943 - July 1943).

a. During the past six months, detailed studies have been made of the following war projects and the necessary recommendations have been offered. The summary is intended only as an outline showing the variety and number of problems studied together with an indication of hazards found.



b. Painting in cold storage warehouses (10 plants).

(1) Methyl alcohol and ethyl alcohol, as solvents in paint, caused severe irritation of the respiratory tract and eyes of painters working in enclosed rooms where ventilation was inadequate. Concentration of the vapors exceeded the lower explosive limit.

c. Camouflage plants #1 and #2.

(1) Women were affected with dermatitis from the use of paint thinner in removing bituminous emulsion contained in paint.

(2) Lead was present in the paint which came off as a fine dust in the weaving operation. During this operation women were exposed to approximately half of the concentration of lead permitted in a working atmosphere.

d. U.S.E.D. Tunnels T-10, T-403, T-71, T-88, T-2291, T-89.

(1) Toxic gases generated by dynamite in tunnel concentration included carbon monoxide, nitrogen oxides, and smaller amounts of other gases.

(2) Dust from mucking, dynamiting and drilling was a problem.

(3) Lack of proper ventilation was a serious handicap.

(4) Other factors included contaminated drinking water and lack of sanitary facilities.

e. Fort Kamehameha Ice Plant.

(1) Ammonia fumes from break in pipe exceeded safe limits.

(2) Chromium compound in brine caused dermatitis.

f. U.S.E.D. Reproduction Plant.

(1) Ammonia fumes from developing box, and nitrogen oxide gases from open arc lamps were found to be contaminating the work-room.

(2) Improper ventilation was in use in the multilith room.

g. Halawa Water Tunnel.

(1) Same difficulties encountered here as in U.S.E.D. tunnels, namely, dust, CO, NO<sub>2</sub> and ventilation.

h. U.S.E.D. Pipe Coating Operations using "Biturene."

(1) Analysis of Biturene which was handled by the workmen in the molten state revealed presence of hydrocarbons, sulfur, hydrogen sulfide, and nitrogen compounds.

i. U.S.E.D. Hot Plants.

(1) In this study, which is not yet completed, hot asphalt, dust, and dermatitis are the hazards.

j. Test on U.S.E.D. fuel tanks. Dredge Holland & QM Barge #53.

(1) Tests for inflammable gases are made on all fuel tanks and bunkers before men enter or begin welding.

k. Test for combustible gases in enclosed tunnel at Bellows Field.

(1) A leaking valve in an aviation gas line developed an explosive concentration in an enclosed pit. Workman was overcome by fumes.

WARREN C. MAWHINNEY,  
2nd Lt., Sn. C., AUS



REPORT OF ACTIVITIES  
INDUSTRIAL HYGIENE DIVISION OF MEDICAL INSPECTOR'S OFFICE, CPBC  
1 January - 31 December 1944

1. Introduction and General Information:

a. The Industrial Medical Program of the United States Army, as outlined in War Department Circular No. 59, is carried on in the Central Pacific Base Command by the Industrial Hygiene Division of the Medical Inspector's Office. The Industrial Hygiene Division is composed of one officer and two enlisted technicians. Laboratory facilities have been provided at the 218th General Hospital, Tripler Area. At the present time, field instruments of the Industrial Medical Department, U. S. Navy, are being used pending arrival of a complete set of instruments and equipment from The Surgeon General's Office. A laboratory equipped with all the necessary instruments and facilities for industrial hygiene work will be in operation in the near future.

b. Activities of the Industrial Hygiene Division from 1 January to 31 December 1944 have included complete surveys of nineteen Army plants, eighteen special projects requiring field tests or laboratory analysis, and nine special assignments including two lectures and three written articles for Essential Technical Medical Data. Inspections of eleven completed Industrial Hygiene construction projects have been made with the Medical Inspector, CPBC. Arrangements have been made for periodic x-rays, physical examinations, and laboratory tests for personnel in more hazardous occupations.

c. Industrial Hygiene problems in the CPBC have been varied, and have included ventilation, lighting, dust control, elimination of toxic gases and fumes, prevention of dermatitis, and the introduction of protective clothing. A considerable amount of money has been involved in the construction of ventilation systems, new lighting facilities, new protective equipment, and other measures for promoting good working conditions.

d. An illustrated lecture for the purpose of educating plant personnel on the subjects of industrial hygiene has been developed and used during the past year.

e. A written report of each industrial hygiene survey was submitted to the Surgeon, CPBC. Photographs were taken of all major improvements instituted by the Industrial Hygiene Section.

f. Field tests and, in certain cases, laboratory analyses were made in every survey as a basis of recommendations for improving working conditions.

Incl. 2

## 2. Industrial Hygiene Surveys and Accomplishments:

a. Little Theatre, APO 957: Installation of exhaust fan and ducts.

b. QM Laundry Area #3: Installation of eight exhaust fans over pressing section, a louver (80' x 5') in marking section, and new lighting facilities in the marking and sorting departments.

c. Exchange Office, Headquarters, CPBC: Abatement of dust problem.

d. CWS Impregnation Plants, APO 957: Installation of three plywood inclosures approximately 8' x 9' x 7' for collecting and exhausting tetrachloroethane fumes; erection of three large exhaust stacks in connection with exhaust fans and extension of fifteen smaller stacks above roof; construction of additional 3' x 3' underground duct in connection with plywood inclosures; installation of one new large exhaust fan and four new sheaves; installation of six supplied air respirators; and construction of three closed condenser units.

e. U. S. Army Printing Plant, Fort Armstrong: Installation of two exhaust fans and new fluorescent lighting fixtures.

f. 3605th Ordnance HAM Co., Fort Armstrong: New lighting facilities; construction of portable metal fume exhaust hood with blower for metallizing unit; installation of three fans in paint shop; measures for prevention of dermatitis.

g. 551st Ordnance HAM Co., APO 957; Removal of blackout; installation of instrument light on machines; elimination of exhaust fumes from dust-proof carburetor room.

h. Underground Telephone Exchange, Bellows Field: Installation of room conditioner.

i. 3606th Ordnance HAM Co., APO 957: Installation of new exhaust line for motor testing unit; installation of new fluorescent lighting facilities; introduction of personal protective equipment for sand blasters and painters; measures for prevention of dermatitis; construction of fume hood for metallizing unit.

j. 356th Ordnance M.M. Co, Fort Ruger: Installation of exhaust fans in paint shop; introduction of respirators for lead grinders.

k. Aliamanu Crater Hot Plant: Abatement of smoke and dust nuisance; installation of "Wet House."



- l. 81st Ordnance M.M. (Tank) Co., APO 957: Removal of blackout; introduction of respirators for painters; installation of exhaust fan in dust-proof carburetor shop.
- m. Typewriter Repair Shop, APO 957: Installation of new fluorescent lighting facilities; construction of fume hood for solvent spraying.
- n. 231st Ordnance M.M. Co., APO 957: Measures for prevention of dermatitis; protective equipment for painters; plans submitted and approved for new battery acid mixing plant.
- o. 3554th Ordnance M.M. Co., APO 957: Stoddard's Solvent substituted for lead gasoline as cleaner; lighting facilities requested.
- p. QM Bakery, APO 957: Installation of new lighting facilities, new mess facilities, drinking fountains and new screening; blackout removed; installation of exhaust fan in bread storage room.
- q. Ordnance Depot, APO 456: Personal protective equipment supplied for personnel working with solvents.
- r. Hawaiian Ordnance Depot, APO 958: Improved ventilation in Parkerizing plant; installation of dust collection machinery and ducts in lumber shop; rifle range sound-proofed.
- s. 14th Medical Laboratory: New lighting facilities installed.

3. Special Projects Conducted by Industrial Hygiene Section:

- a. Washing and sterilizing heavy woolen socks, cushion sole: Laboratory tests were made to devise a suitable method of washing socks in the field to prevent undue shrinkage and provide sterilization of fungi.
- b. Ammonia fumes at Fort Kam ice plant: Chemical tests were made in plant to determine concentration of ammonia fumes.
- c. Tests for Carbon monoxide at T-26, Waipio: Tests for carbon monoxide were made in Tunnel T-26 at request of Safety Engineer, USED.
- d. Analysis of Bendix Cleaner: Laboratory analysis of "Bendix" cleaner was made to determine irritant substance.
- e. Irritant properties of kerosene and Stoddard's Solvent: Patch tests were made in the laboratory to determine relative degree of skin irritation caused by kerosene and Stoddard's solvent.

f. Combustible Gas Tests: Tests were made at Ordnance Depot, Aliamanu Crater, prior to removal of gas tanks.

g. Dredge Sacramento: Tests for combustible gas and lead dust. Introduction of personal protective equipment.

h. Tetra-ethyl lead: Study of lead concentration in U. S. Army ranges using tetra-ethyl lead gasoline.

i. U. S. Army Dredge B 61730: Tests for combustible gas.

j. Protective equipment for graves registration details: Tests requested by 27th Division to determine suitable protective equipment for graves registration details handling dead bodies on battle-fields. A Navy type M.S.A. cartridge respirator was supplied for protection against organic vapors.

k. Welding and Metallizing Shop, Base 6: Inspection requested by Safety Engineer, USED.

l. Surgeon's Office: Plans drawn up for soundproofing Surgeon's Office, CPBC.

m. Fumigation and Termite Control: Inspection of methods used in CPBC. Personal protective equipment introduced.

n. Lighting facilities for 18th Medical General Laboratory: Plans for new lighting facilities for laboratory were checked.

o. Memorandum on Stoddard's Solvent: Plans for reclaiming used Stoddard's Solvent were drawn up by Industrial Hygiene Section.

p. Circular, CPBC: A circular on Industrial Hygiene was prepared for distribution in CPBC. This has not been published to date.

#### 4. Special Assignments and Reports:

a. "Chemical Procedures for Determining Tetrachloroethane": A report written at the request of Captain A. H. Laube for use by the 110th Chemical Processing Co., APO 957.

b. "Sanitary Control of Milk, Ice Cream, and Soft Drinks": A lecture given by Lt. W. C. Mawhinney to officers of the Medical Inspector's Office.

c. "Exhaust System for Metallizing Units": A report submitted for publication in ETMD.



d. "Study and Report of Literature on Fatigue": Report submitted at request of Deputy Surgeon, CPA.

e. "Industrial Hygiene in CWS Impregnation Plants": This report is being prepared for publication in ETMD.

f. "Industrial Hygiene": A lecture delivered to the Officer's Candidate School by Lt. W. C. Mawhinney.

g. "Recommendation for Removal of Blackout": A report submitted to the Surgeon, CPBC.

h. "Development of Camouflage Plants": This report was written for publication in ETMD.

5. Medical Program:

a. Physical examinations and laboratory tests were instituted at 147th General Hospital and 14th Medical Laboratory for CWS Impregnation Plant personnel.

b. X-rays were given to lead grinders of 356th Ordnance M.M. Co., Fort Ruger.

c. Lanolin was supplied to all Ordnance shops for prevention of dermatitis.

6. Inspections: Inspections of the following plants were made by the Industrial Hygiene Officer and the Medical Inspector, CPBC:

a. 551st Ordnance Depot, APO 957.

b. 231st Ordnance HAM Co., APO 957.

c. 3606th Ordnance HAM Co., APO 957.

d. 3605th Ordnance HAM Co., Fort Armstrong.

e. 356th Ordnance M.M. Co., Fort Ruger.

f. QM Laundry, Area #3, Kaneohe.

g. QM Laundry, APO 957.

h. CWS Impregnation Plants (2), APO 957 and Typewriter Repair Shop, APO 957.

i. QM Bakery, APO 957.

- j. Waikakalaua Tank Farm, Waikakalaua.
- k. QM Laundry, East Range, APO 957.
- l. Pearl Harbor Navy Yard.



Inclosure 3 is War Department Circular 198 dated 20 May 1944.

"Industrial Medical Program of United States Army"

Incl. 3

Inclosure 4 is War Department Circular 155 dated 28 May 1945 which contains a section on the Army Industrial Medical Program.

Incl. 4



## LIST OF REFERENCES

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10. Special Orders No. 177, Hq Hawaiian Dept, Ft. Shafter, T. H., 26 Jun 1943.
11. Special Orders No. 196, Hq Hawaiian Dept, Ft. Shafter, T. H., 15 July 1943.
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"Increasing Height of Exhaust Stack Above Roof of Impregnation Plants," IBID. Fume Hoods for Chemical Laboratories, 110 Chemical Processing Company, APO 957, IBID.
14. "Survey of Chemical Warfare Service Impregnation Plant, Bldg 1663," IBID.
15. "Industrial Hygiene in Chemical Warfare Service Impregnation Plants," ETMD, CPBC, March, 1945.
16. Report of Activities, Industrial Hygiene Division of Medical Inspector's Office, CPBC, 1 January - 31 December 1944, Industrial Hygiene, File No. 729.3, Surg's Off Hq, CPBC 1944, Incl No. 2.
17. Acknowledgement fr TSG Off, par 2a-b re ETMD Report of 19 Apr 1945, CPBC.
18. WD Cir No. 198, Incl No. 3.
19. Proceedings of a Board of Officers Convened Pursuant to Par #1, Special Orders #20, Hqs, Chemical Warfare Service, CPBC, Copies of Report are available at Hqs, CWS, CPBC, 28 February 1945.
20. WD Cir No. 155, Incl No. 4.



## CHAPTER 40

### Civil Public Health

The health of the civilian population of the Territory of Hawaii during World War II was good. The over-all civilian death rate reached an all-time low of 5.7 deaths per estimated thousand of population during the fiscal year of 1945.<sup>1</sup> This is a lower death rate than has ever been recorded for any State. In part, the low death rate results from the relatively large proportion of the population in the lower age groups. There have been no civilian catastrophies. Tuberculosis and dengue fever have been the only communicable diseases of major importance. Tuberculosis ranks fourth among the leading causes of death in the Territory. Efforts toward the control of tuberculosis have been considerably intensified during the war. This has been possible to a great extent through the assistance of the Army in providing additional hospitalization facilities for contagious diseases. A dengue fever outbreak beginning in July 1943 was brought under control during the first half of the year, 1944, through vigorous control measures, largely supported by the Army. There have been two outbreaks of measles, two mild outbreaks of influenza, and two small outbreaks of poliomyelitis. Early in 1942, there occurred an outbreak of 75 typhoid fever cases traced to the cafeteria of a public school. This occurred prior to compulsory immunization of all civilians against small-pox and typhoid-paratyphoid fevers in 1942. The ten leading causes of death in the Territory for the fiscal year 1944-45 are shown below:

#### Ten Leading Causes of Death, Territory of Hawaii\*

Rank No.	Cause of Death	Total Deaths	
		1944	1945
1	Diseases of the heart (90-95).	579	532
2	Cancer and other malignant tumors (45-55).	365	358
3	Congenital malformations and diseases of early infancy (157-161).	259	276
4	Tuberculosis (13-22).	272	265
5	Nephritis (130-132).	235	214
6	Intracranial lesions of vascular origin (83).	197	192
7	Violent or accidental deaths (exclusive of homicide and suicide) (169-195).	271	188
8	Pneumonia (107-109).	146	119
9	Diabetes mellitus (61).	81	73
10	Suicide (163-164).	50	45

\* Civilian population estimates, Territory of Hawaii, as of 1 July 1944, 492,379; 1 July 1945, 502,122.

During the first year of the war the Office of Civilian Defense, the Territorial Board of Health, the U. S. Public Health Service, and the Army maintained the closest possible liaison in matters of civilian public health and medical care. Both the military and civilian community were dependent upon one another in the defense of the vital military and Naval bases in the Territory.

Two emergency hospitals were established under the Office of Civilian Defense (Wahiawa and Sacred Hearts), and additional temporary hospital wards were set up at Kuakini Hospital. Army assistance was given to the construction of badly needed new additions to Queen's Hospital, St. Francis Hospital, and Kapiolani Hospital.<sup>2</sup> When it became necessary that the Army take over the U. S. Public Health Service Quarantine Station at Sand Island, it was arranged that in case of a civilian epidemic the Army would provide the necessary hospital facilities.<sup>2</sup> Certain categories of civilian medical and hospital personnel have been very limited, so much so that Army personnel, including medical officers, nurses, hospital corps-men, and medical and sanitary technicians have been provided to the civilian community from time to time. These personnel have been supplied by the Army without charge.<sup>3-6</sup> In 1942, the Army appointed a medical officer to act as Civilian Hospital Control Officer to keep check as to where bed vacancies existed among the civilian hospitals, particularly in order that night emergency cases would receive prompt treatment.<sup>7</sup> The Army established a policy of accepting civilian emergency cases for hospital treatment in all instances where civilian facilities were not available. This policy has continued up through the present time.

Repeated checks have been made from time to time by representatives of the Surgeon, Hawaiian Department, concerning the adequacy of office-type medical care for civilians.<sup>8</sup> Physicians' offices have operated under stress, reception rooms have been crowded, and appointments for non-urgent cases have often necessarily been made weeks in advance. The services of physicians for home visits have been difficult to obtain. The adequacy of the number of physicians in the Territory has not been measurable as a simple quotient of the number of physicians divided by the population. Physicians practicing singly, particularly the large number of Oriental physicians have not been as busy as the larger clinics and medical groups centrally located in Honolulu. There have been approximately 220 physicians on the island of Oahu to service approximately 340,000 civilians, a ratio of 1:1600. It has been the opinion of the President of the Honolulu County Medical Society and the Director of the Procurement and Assignment Service for the Territory of Hawaii that civilian medical care has been adequate. During 1945, the Procurement and Assignment Service for the Territory certified the availability of 83 civilian physicians for service with the Navy. Only a few of these physicians



have actually gone into Navy service. Inasmuch as 19,700 of the 28,500 civilian Army employees have been hired from among the civilian population on Oahu, this has resulted in considerable relief of civilian medical facilities. Employees of the U. S. Engineering Department and the Hawaiian Air Depot have been provided with dispensary service, and in the case of the Hawaiian Air Depot with hospitalization.

During the early period of the war many civilians were brought to Oahu for employment by the Army who were in poor physical or mental health. These civilians imposed a heavy burden upon Army and civilian medical facilities, particularly the latter. During the past two years the medical screening of civilian Army employees on the mainland before transfer to Oahu has greatly improved. In 1945, a representative of the Office of Civilian Personnel, Central Pacific Base Command, was sent to the Seattle Port of Embarkation in the interests of further improving the screening program. The Surgeon, Central Pacific Base Command, has cooperated in the preparation of a medical guide for the selection of civilian Army employees for the Territory based on past experience.

Housing on the island of Oahu has been very inadequate. However, this inadequacy has existed with very little measurable effect upon the health of the civilian community. The mild equable climate demands a minimum of provision for housing. Endemic typhus fever has shown an increased incidence during the war, but a reduction in the normal peacetime rat control program among civilian residences may be the responsible factor. The 1945 Territorial Legislature has appropriated funds for the institution of typhus fever control measures in Honolulu during the coming two years. Crowded civilian housing facilities were considered when the Surgeon, Hawaiian Department, took the initiative in 1942, in eliminating the list of active tuberculosis cases awaiting admission to public sanatoria by arranging for the admission of the necessary number of these cases to Army hospital facilities.

The Army has assisted as much as possible in the provision of housing for civilians. In 1945, the Army was housing 7,729 civilian employees in the Territory.

Water supplies have been satisfactory. The Army has taken the initiative in accomplishing chlorination for the major civilian water distribution systems. All water distributed to Honolulu has been chlorinated from November 1943, up through September 1945.

The food situation in the Hawaiian Islands has not been as critical as on the mainland. There has been no food rationing

program. Native fruits and vegetables, coffee, sugar, seafoods, and meats have usually been available, (see Chapter 24 concerning Nutrition). The prohibition of the serving of milk in Army messes except for hospitals has conserved the available milk supply for the civilian population. Of the food items only fresh meats have become scarce from time to time during the latter half of the war period. Local fishing grounds have not been fully exploited during the war because of the necessary restrictions upon fishing applied by the Navy. During the latter part of 1944 and early 1945, the restrictions limiting fishing have been progressively lifted.

The first of a series of orders regarding immunization of the civilian population of the Territory of Hawaii against smallpox and typhoid-paratyphoid fevers was issued from the Office of the Military Governor on 17 February 1941.<sup>9</sup> This order required the immunization of the rural civilian population in the northern section of the island of Oahu. Subsequent orders extended the area until all Oahu, including Honolulu, and the Islands of Hawaii, Maui, and Kauai were included. All persons over the age of 3 years were required to be immunized against typhoid-paratyphoid fevers, and vaccination against smallpox was required of all persons over the age of six months, unless such persons had been so immunized since 1 January 1941.<sup>10</sup> Exemptions and deferrals were provided for persons who were actually ill, infirm, aged, crippled, or who suffered from any condition which in the opinion of a physician might be aggravated by either typhoid or small pox vaccinations. The Board of Health working in collaboration with The Office of The Surgeon, Hawaiian Department, undertook the administration of the program.<sup>11</sup> Triple typhoid vaccine and vaccinia virus as well as certain supplies and equipment were furnished by the U. S. Army. Army medical officers and nurses assisted in the vaccination program at the various vaccination centers whenever assistance was needed. Private physicians had their place in the program and cooperated fully. The Honolulu County Medical Society adopted a fee schedule applicable during the program of one dollar per injection of typhoid vaccine and one dollar for vaccination, and similar action was taken by the other island county societies. Time was given for individuals to be vaccinated by their own physicians if they so desired, and private physicians on Oahu vaccinated approximately one-half of the civilian population of the island prior to the opening of the free vaccination centers in Honolulu. Of the total enumerated population of the Territory of 416,886, the number immunized or excused as of 1 September 1942 was 383,620. The number who were immunized against typhoid-paratyphoid fevers was 361,342, against smallpox 366,067, and against diphtheria 18,017.<sup>12</sup> The results in the reduction of typhoid fever cases in the Territory were outstanding. During the years 1943 and 1944 there were only a tenth as many cases as there had been in 1940 and 1941, in spite of war-time conditions. Upon relaxation of military law in March, 1943, Hawaii Defense Act



No. 60 was prepared and passed to take the place of the military order requiring vaccination against the typhoid fevers and smallpox. By Hawaii Defense Act Rule No. 93, booster injections were required for those who had their first series in 1941-42.

Diphtheria immunization was not required for civilians in 1942, but all parents were urged to have their children between the ages of nine months and ten years protected against this disease if they had not previously been immunized. Hawaii Defense Act Rule No. 60, in 1943, made diphtheria immunization for children mandatory.

Immunization against tetanus was not included in the program. The advisability of including this immunization was given careful consideration, but was not considered necessary in the interest of public health. The wisdom of this decision was not tested by the course of events, as no enemy invasion with attending civilian casualties occurred. During the years 1944 and 1945, there were 18 and 15 civilian cases of tetanus in the Territory, with 6 and 10 deaths respectively.<sup>13</sup> The large number of cases of tetanus among enemy civilian casualties resulting from the invasion of Saipan might serve as a warning in case preparation of civilians for war may again become necessary.

The number of cases of communicable diseases among civilians has shown a steady increase during the war years, but has remained below the all-time high of 26,073 during the fiscal year 1940-41. The incidence per capita has decreased. The number of deaths from communicable disease have decreased. Comparative figures are shown below:

<u>Year</u>	<u>Number of Cases</u>	<u>Approx. Rate Per 1000 Per Annum</u>	<u>Communicable Disease Deaths</u>	<u>Approx. Death Rate Per 1000 Per Annum</u>
1940-41	25,570	55	469	1
1941-42	6,644	15	474	1
1942-43	14,151	30	469	0.97
1943-44	18,172	37	468	0.95
1944-45	20,162	40	442	0.88

A tabulation of Communicable Disease Cases, Territory of Hawaii, is as follows:

Disease	1941-42		1942-43		1943-44		1944-45	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Dengue	0	0	0	0	1502	3	36	0
Diphtheria	73	0	90	2	24	0	37	2
Dysentery	79	2	226	1	372	2	395	0
Bacillary								
Gonorrhea	1220	0	1255	0	1292	2	944	1
Influenza	293	13	4288	15	7002	12	3765	6
Measles	712	1	137	0	888	0	10264	16
Measles, German	226	0	282	0	113	0	191	0
Meningitis	6	3	34	5	60	5	33	4
Parotitis	178	0	2966	0	3008	0	818	0
Pertussis	638	16	1531	12	880	5	90	0
Pneumonia, lobar	300	57	188	47	110	38	86	27
Polio-myelitis	31	5	74	0	8	0	4	0
Scarlet fever	20	0	51	1	55	0	50	0
Syphilis	871	52	1049	61	823	62	503	48
Tetanus	30	8	17	7	18	6	15	10
Tuberculosis	766	269	1072	274	1121	282	1042	284
Typhoid fever	121	7	9	2	5	1	7	2
Typhus fever	88	1	74	0	186	2	152	2
Varicella	457	0	1441	1	1427	0	1151	1
Others	535	40	439	41	399	48	579	39
TOTAL	6644	474	15223	469	19293	468	20162	442

An epidemic of typhoid fever occurred in Honolulu in March, 1942, among the students of one of the intermediate schools. There were 78 cases and 5 deaths. Practically all cases were hospitalized, almost all of them by the Army. Epidemiological and laboratory investigation pointed to the school cafeteria as the source of the epidemic. One of the employees, a girl of 17, was detected as a carrier and the probable focus of infection. Army epidemiologists actively assisted the school nurses in visiting absentee pupils from this school and bringing all of those pupils suspected of having typhoid fever into the hospital for observation and treatment. Nevertheless, three cases occurred in homes among individuals not attending the school, secondary to cases in pupils which had missed detection. Following the typhoid-paratyphoid fever immunization program which was completed during the fiscal year 1942-43, the incidence of typhoid fever in the Territory showed a marked fall:



### Typhoid Fever in Territory of Hawaii

<u>Year</u>	<u>Cases</u>	<u>Deaths</u>
1940-41	69	7
1941-42	121	7
1942-43	9	2
1943-44	5	1
1944-45	7	2

After an epidemic during the fiscal year (July-June) 1941-42, measles remained low in incidence until April, 1944, when numerous cases were imported to the Territory with the arrival of children of island residents from the mainland. This was followed by a considerable epidemic of measles during the fiscal year 1944-45, to be expected in a comparatively young island population.

Influenza has been epidemic during the 1940-41 period. In June, 1943, influenza again appeared in mild form, beginning in rural Oahu, and spreading to Honolulu and the other islands during July, August, and September. During this outbreak there were over 11,000 reported cases. In the spring of 1945, another mild outbreak of influenza occurred, determined by an Army laboratory to be Type B. There were 3765 cases reported by the end of the fiscal year (June, 1945).

Dengue fever was introduced into Honolulu in July, 1943, after being absent from the Territory for two decades. The history of this outbreak, amounting to over 1500 reported civilian cases, is more fully described under the chapter on arthropod-borne infections. Prompt control measures were instituted. The Army and U. S. Public Health Service cooperated wholeheartedly with the Board of Health. The epidemic was brought under control during the first half of 1944.

Eleven cases of poliomyelitis had occurred during the fiscal year 1941-42. In July, 1942, poliomyelitis appeared again, reaching a peak in October and November. There were 32 cases in this outbreak ending in December, 1942. In February, 1943, poliomyelitis appeared again, and by the end of the fiscal year (June, 1943) 74 cases had been reported. Through the combined efforts of the Office of Civilian Defense, the Territorial Board of Health, and the Army, a poliomyelitis hospital was set up to isolate and treat cases. The Army provided a number of nurses and hospital corpsmen.

Tuberculosis ranked fourth among the leading causes of death in the Territory during the fiscal year 1944-45. The number of new cases reported during each year of the war has increased. Many factors have influenced tuberculosis statistics which make their

interpretation difficult. A considerable number of the reported cases have occurred in war workers who were subsequently returned to their mainland homes for care. During the past few years the tuberculosis case finding program has been greatly improved in the Territory, particularly through the use of a 4" x 5" mobile photoroentgenographic unit. During the 1944-45 fiscal year, 37,000 chest x-rays were taken by the Board of Health in tuberculosis surveys. The emphasis in these case finding surveys has been placed on certain groups: industrial, selective service, low economic, teachers, food handlers, tuberculosis contacts, war workers, and pregnant women. In general, approximately 2% of those surveyed have shown X-ray evidence of tuberculosis. Only 31.6% of cases found have been in the minimal and easily treatable stage. The number of new tuberculosis cases and mortality rate for tuberculosis in the Territory for each year of the war is shown below:

Civilian Tuberculosis Cases, Territory of Hawaii

<u>Year</u>	<u>New Cases</u>	<u>Mortality/100,000</u>
1939-40	715	63.2
1940-41	740	53.3
1941-42	766	57.3
1942-43	1072	56.6
1943-44	1121	57.8
1944-45	1353	54.9

Immediately following the enemy attack, 7 December 1941, a number of tuberculosis patients at Leahi Hospital, Territorial Tuberculosis Hospital on Oahu, were discharged to provide hospital space for possible additional battle casualties. Later some of these patients were readmitted to Leahi Hospital, but it was not possible to readmit all of them. Many newly discovered and reactivated cases had occupied the limited facilities. Furthermore, there was a serious shortage of doctors, nurses, and orderlies at Leahi Hospital. In March 1942, the Army hospitalized three civilian patients with tuberculosis who had been disciplinary problems at Leahi, and who had been offered prison sentences or hospitalization by the Office of the Military Governor.<sup>14</sup> In August 1942, the Army accepted an additional 25 civilian patients who were active cases, of danger to the community, but who could not be admitted to Leahi Hospital for lack of facilities. In October, 1942, and for several months thereafter the Army loaned Leahi Hospital a medical officer experienced in the treatment of tuberculosis.<sup>15</sup> In November, 1942, the Army accepted an additional 100 civilian tuberculosis patients, eliminating for the first time in the history of the island of Oahu the list of active tuberculosis cases awaiting hospital treatment.<sup>16</sup> During the years 1943-45, the Army admitted 358 civilian tuberculous patients. These admissions were to have been a temporary expedient. The Office of Civilian Defense was to construct a 100 bed unit for tuberculosis cases adjacent to the OCD Hospital at Wahiawa.



However, this Wahiawa unit was not completed until November, 1943, at which time the Army was hospitalizing approximately 170 tuberculosis cases. When 100 of these cases were moved to Wahiawa, the Director, OCD, requested that the Army furnish a medical officer to care for them. The Army agreed to provide consultation service only.<sup>17</sup> Since that time, the Army has continued to provide hospitalization for the remaining cases, the Army census being 51 in June, 1944, and 43 in June, 1945. Further admissions of civilian tuberculosis patients to Army hospitals have been curtailed. Throughout the three years the Army received monthly financial reimbursements from civilian agencies for the subsistence and medicinal accounts of these patients to the amount of \$1.75 per patient per day; however, repeated difficulties have been experienced in the collection of these bills from the many different agencies involved. One of the original plans considered in 1942, had been to build additional temporary wards on Leahi Hospital grounds for the accommodation of the civilian patients. This plan had been disapproved by the Department Surgeon, because of the already congested conditions at Leahi, and proximity of military objectives. Had some plan of expanding existing civilian tuberculosis hospitalization facilities been possible, even if it would have been necessary for the Army to provide certain personnel, the Army might not have been burdened with these tuberculosis patients for so long a period.

The period of the war has shown a consistent growth in the venereal disease control program in the Territory. During this period the venereal disease rate for locally acquired venereal diseases among Army troops in the Territory has fallen below one per thousand per annum. The total number of venereal disease cases reported has increased each year, but more and more of them have had their source of infection in the mainland. The numbers of venereal disease cases reported in the Territory by years, and the proportion of these which have had the source of their infection on the mainland are shown below:

Gonorrhea Cases in Territory of Hawaii

<u>Year</u>	<u>Local Infections</u>	<u>Off-shipping Cases</u>
1942-43	1093	123
1943-44	1155	442
1944-45	856	903

## Syphilis Cases in Territory of Hawaii

<u>Year</u>	<u>Local Infections</u>	<u>Off-shipping Cases</u>
1942-43	214	67
1943-44	65	126
1944-45	51	303

Serological tests for syphilis taken during Selective Service examinations in 1942 showed approximately 2% positives.

The control of venereal diseases in the Territory in spite of the large numbers of introduced infections has been a considerable achievement by the Board of Health. Case finding through the tracing of contacts and sources of infection has been efficient. An impetus was given to this program in April, 1942, with the passage by the Military Governor of General Order No. 107. This order required the reporting of all cases of venereal disease to the Board of Health within 24 hours after diagnosis by medical officers of the Army and Navy, as well as civilian physicians, provided for the naming of and investigation of contacts, and made the Board of Health responsible for placing infectious civilians under proper surveillance, the expeditious investigation of contacts, and the return of delinquent cases for proper treatment. For a period in 1942-43, the Army provided hospitalization in a part of a local civilian hospital for the treatment of infected women found in the case-finding program who could not or would not provide their own private physicians. With the relaxation of military law in March 1943, General Order No. 110 (1943) was passed to replace General Order No. 107 (1942) which automatically became rescinded. General Order No. 110 has remained in effect during the emergency.

Openly acknowledged houses of prostitution flourished in the Territory until 1943, when prostitution was suppressed on Maui and Kauai, and September, 1944, when prostitution enterprises amounting to ten million dollars a year were closed down in Honolulu. Contact statistics for military infections showed that 66-75% of them were contracted from professional prostitutes, however, the military venereal disease rate for locally acquired infections was quite low. Since the closing of the houses of prostitution the military venereal disease rate for locally acquired infections has become lower. Comparative statistics for all VD cases before and after the closing of the brothels on Oahu have shown a 38% reduction in gonorrhea and a 44% reduction in syphilis.

While professional prostitution was flourishing in the Territory, as many as 40,000 prophylactic treatments were given at Army prophylactic stations each month. A certain proportion of these treatments were given to civilians.



The Territorial Legislature, in 1943, passed a law requiring a serological test for syphilis for all pregnant women. In 1945, the Legislature passed a law requiring a serological test for syphilis as a prerequisite for a marriage license in the Territory. Blood serologic tests have been required of civilian food handlers.

During the fiscal year the Territorial Board of Health released free of charge 54,500,000 units of penicillin for the treatment of gonorrhea and syphilis cases. Results were reported as very successful.

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## CHAPTER 41

### Foreign Quarantine and The Disinsectization of Aircraft

#### (History of Preventive Medicine)

The interest of the Hawaiian Department in foreign quarantine was stimulated in May 1941, following receipt of a letter from the Chief Quarantine Officer, U. S. Public Health Service, Honolulu, concerning compliance of 21 Army bombers arriving on Oahu with the provisions of Foreign Quarantine Division Circular No. 71.<sup>1</sup> Investigation showed that these Army planes had not complied with the quarantine directive, and action was taken in letters to the Honolulu Quarantine Office and The Adjutant General to prevent the recurrence of such omissions.<sup>2</sup> Arrangement was made that the U. S. Public Health Service would be notified in advance of such plane arrivals. The U. S. Public Health Service was to provide as many as thirty hand sprayers and insecticide, and the Army was to detail the necessary personnel to accomplish necessary spraying of planes.<sup>3</sup> The Commanding General, Hawaiian Air Force, was directed to give the necessary orders to effect compliance with this arrangement.<sup>4</sup> In November 1941, the Army consulted the Navy for information as to the method by which aircraft landing at the Pearl Harbor Navy Yard, or other Naval Stations in the Territory were disinsecticized, after flights originating outside of the Hawaiian Islands. The Navy in reply referred to 14th Naval District, District Order No. 58-41, dated 30 September 1941.<sup>5</sup> On 30 October 1941, the Commanding General, Hawaiian Department received a letter from the Secretary, Hawaiian Sugar Planters' Association<sup>6</sup> emphasizing the dangers to the sugar industry and to the entire Territory of the introduction of crop destroying and disease carrying insects by aircraft. Army air traffic was increasing greatly, and military secrecy precluded the certainty that civilian quarantine authorities could be notified. Upon the recommendation of the Surgeon, Hawaiian Department,<sup>7</sup> a radio was sent to The Adjutant General, Washington, D. C., dated 8 November 1941, requesting authority to establish an Army disinsectization service under Medical Department control at Hickam Field and other fields where planes from infected points stopped.<sup>8</sup> The Hawaiian Sugar Planters' Association had offered the services of entomologists in their employ stationed at Canton and Midway Islands for the inspection and disinsectization of Army planes enroute to Hawaii. This service was accepted and the necessary letters were sent.<sup>9-12</sup> Upon receipt of radio authority from the War Department for the establishment of an Army disinsectization service, the Commanding Officer, Hickam Field, was instructed by letter dated 25 November 1941, to procure the necessary equipment



and institute this service on a 24 hour basis.<sup>13</sup> A copy of the letter of instruction to the Commanding Officer, Hickam Field, was mailed to The Adjutant General, Washington, D. C., with a request that authority be obtained to substitute an Army inspection service for the inspections of the Chief Quarantine Officer, U. S. Public Health Service, and the U. S. Department of Agriculture.<sup>14</sup> Approval for this action was indicated in four indorsements and an added inclosure to the request; however, since the Territory had passed under martial law, further action was left by the War Department with the Military Governor of the Territory. Authority for the substitution of a single Army inspection and disinsectization service at Hickam Field for the services of the Chief Quarantine Officer, U. S. Public Health Service, and the Plant Quarantine Inspector, U. S. Department of Agriculture, in Honolulu was given in General Orders No. 77, Office of the Military, Territory of Hawaii, dated 24 February 1942.<sup>15</sup>

In compliance with Foreign Quarantine Division Circular No. 71, U. S. Public Health Service, as revised 20 December 1941, radio request was made to the U. S. Public Health Service, through the War Department, on 6 February 1942, for authority to designate the senior medical officer of each airfield in the Hawaiian Department as quarantine officer for the inspection and treatment of military aircraft.<sup>16</sup> Approval for this was not received until 3 July 1942.<sup>17</sup> In the meanwhile, on 16 February 1942, the Commanding General, Hawaiian Air Force, directed that all airplane commanders departing for stations in the South Seas or Far Eastern Theater would make entries on AC Form No. 1a whether or not yellow fever bearing mosquitoes were present in that locality and the date of each spraying of aircraft and the station where accomplished, these entries to be reported to the proper authority at the first stop in the Netherland East Indies.<sup>18</sup> In April 1942, the Commanding General, Hawaiian Department directed<sup>19</sup> that the senior medical officers present at six outlying air bases in the Pacific, enroute to the Australian area be designated as acting quarantine officers for the purpose of disinsectizing and inspecting all arriving and departing aircraft in accordance with Army Air Forces Regulations No. 61-3, dated 11 February 1942. In May 1942, the Surgeon, Hawaiian Department, instituted a program of search of all planes arriving from places other than the Hawaiian Islands for insects dead or alive, in order that an estimate could be made of the results of the disinsectization procedures.<sup>20</sup> <sup>21</sup> The first progress report giving the results of these plane inspections was forwarded to The Surgeon General, U. S. Army, by letter, Headquarters Hawaiian Department, (MED) 720.4, subject: Quarantine of Aircraft, dated 24 June 1942. In June 1942, instructions concerning inspection of plants were received from the Plant Quarantine Inspector, U. S. Department of Agriculture, and were transmitted to the Surgeon, Seventh Air Force and Surgeon, 7th Bomber Command.<sup>22</sup> Circular No. 42,



Headquarters, Hawaiian Department, Quarantine Officers, was published 9 July 1942.<sup>23</sup> Instructions for air base quarantine officers were published in letters, Headquarters Hawaiian Department, subject: Procedure for Quarantine Officers, 12 July 1942, to each quarantine officer concerned.<sup>23.0</sup>

Necessary liaison was maintained between the Hawaiian Department and Air Transport Command to insure compliance of aircraft with quarantine directives of the Hawaiian area. <sup>23.1, 23.2, 23.3</sup> of ATC

In October 1942, a representative of the Surgeon, Hawaiian Department, worked with an officer of the District Medical Office, 14th Naval District, to assist the Navy in organizing a program of disinsectization and inspection of Navy planes similar to that of the Army program.<sup>24, 25</sup>

In January 1943, the Commanding General, Hawaiian Department, received a report from the Commanding Officer, Christmas Island, the existing directives in respect to the disinsectization of aircraft were not being complied with by many aircraft arriving at that station. Steps were taken to achieve corrective action and improve practices of all aircraft at all stations.<sup>26</sup>

In December 1941, the Territorial Department of Agriculture reported that some live pets, including a raccoon, had been brought ashore and were then in the possession of newly arrived Army units. Such action was in violation of Territorial regulations requiring that such animals be placed in 4 months quarantine. Steps were taken to recover the animals, and commanding officers were notified of the Territorial laws.<sup>27</sup> In April 1942 commanders were again reminded of the necessity of compliance with Territorial laws in this difficult matter,<sup>28</sup> and the Commanding General, Port of Embarkation, Fort Mason, California, was advised that the bringing of animals by individuals or organizations to Hawaii was prohibited.<sup>29</sup> Circular No. 81, Headquarters Hawaiian Department, Quarantine of Animals and Birds, was published 30 June 1943, for further emphasis of this subject.<sup>29.1</sup>

On 10 March 1943, with the reestablishment of certain civilian rights of government, all previously published orders of the Military Governor were revoked, including General Order No. 77. Effective 10 March 1943, new General Orders were published, among them General Order No. 12 to replace General Order No. 77.<sup>30</sup> This order has remained in effect up through the present, September 1945.

On 5 June 1943, the Commanding General, Hawaiian Department received a radio<sup>31</sup> expressing concern with reported failures to enforce strict compliance with AAF Regulation 61-3, dated 30 November 1942, and requesting that report be given the War Department on the matter. Reply by radio was to the effect that existing regulations were being complied with. A full report of quarantine activities within the Hawaiian



Department was forwarded to The Adjutant General, Washington, D. C., by airmail, 13 June 1943.<sup>32</sup> It was evident that the War Department felt that existing regulations regarding the quarantine of aircraft were not being fully complied with. A letter was sent to the Commanding General, Seventh Air Force, directing that quarantine officers be alerted to full compliance with quarantine regulations, and that quarantine of aircraft not be carried out in a casual or routine manner.<sup>33</sup> In July 1943, a medical officer representing the Surgeon, Hawaiian Department, made a trip to Fanning, Christmas and Canton Islands to observe disinsectization procedures.<sup>34</sup> Deficiencies noted were reported through command channels. During the same month another report of deficiencies in aircraft disinsectization was made by the Surgeon, Christmas Island.<sup>34.1</sup> Command attention was given to this matter.<sup>34.2</sup> Between July 1942, and January 1943, the Surgeon, Hawaiian Department required weekly memoranda from the quarantine officer, Hickam Field, to the effect that transient aircraft were being faithfully sprayed on arrival and departure, that planes were being inspected for insects, and that planes were supplied with spray guns and insecticide on departure.

Upon the recommendation of the Hawaiian Department Surgeon, the Military Governor of Hawaii, on 1 November 1943, called a meeting of all military and civilian agencies concerned with foreign quarantine. This meeting was called in order that there might be no uncertainty regarding the quarantine methods in practice, and to determine if all agencies were satisfied that their respective quarantine functions were being adequately discharged by them, or by Army or Navy substitution. Representatives of the U. S. Public Health Service, the U. S. Department of Agriculture, the Territorial Board of Agriculture and Forestry, and the District Medical Office, 14th Naval District attended.<sup>35</sup>

Following the November meeting on quarantine the draft of a proposed comprehensive quarantine directive was prepared<sup>36</sup> and submitted to the Commanding Generals, Army Port and Service Command, Seventh Air Force, and Pacific Wing Air Transport Command, and to the Surgeon, Seventh Air Force (Air Quarantine Officer) for comment. The provisions of this proposed directive were agreeable to the Commanding General, of the Seventh Air Force, the Commanding General, Pacific Wing, ATC, and to the Air Quarantine Officer, but were criticized by the Commanding General, Army Port and Service Command, on the basis that they included too great detail.<sup>37</sup> The proposed quarantine directive was defended by the Surgeon (Hawaiian Department)<sup>38</sup> but his opinion was overruled, and on 27 December 1943, it was directed that the draft of the proposed directive be revised to eliminate too detailed instructions. An abbreviated directive, HUSAFICPA, File AG (Surg) 720.4 subject: Quarantine requirements and responsibilities, was approved and published 13 January 1944.<sup>39</sup>



To implement the general provisions of Letter, HUSAFICPA, File AG (Surg) 720.4, subject: Quarantine Requirements and Responsibilities, 13 January 1944, the subordinate echelon responsible for administration of Army Ports in the Hawaiian Area, the Army Port and Service Command, published Annex No. 1 to Administrative Order No. 1, Headquarters Army Port and Service Command, subject: Quarantine Measures, USAT Vessels Entering Honolulu and Outlying Ports of AP&SC, dated 12 February 1944, and Changes No. 1, thereto, dated 15 February 1944.<sup>40</sup> The above directive implemented the provisions of Foreign Quarantine Circular No. 85, U. S. Public Health Service, dated 4 October 1943. The services of Co. A, 305th QM Bn. Sterilizing Units was authorized for necessary delousing procedures. At the request of the Territorial Board of Agriculture and Forestry and the Chief Quarantine Officer, U. S. Public Health Service, Honolulu, Change No. 2, dated 14 March 1944, to the AP&SC quarantine directive was published concerning importation of animals, birds, and insects.<sup>41</sup>

By the provisions of the USAFICPA Letter, Quarantine Requirements and Responsibilities, dated 13 January 1944, responsibility for the control of entry of animals and birds, as required by Federal and Territorial laws, was fixed upon the Commanding General, Army Port and Service Command, and the Air Quarantine Officer, or their representatives. Change No. 2 to the Hq. AP&SC directive, Quarantine Measures, USAT Vessels Entering Honolulu and Outlying Ports of the AP&SC, dated 14 March 1944, further extended the responsibility to the Commanding Officers of all grades, as well as the individual custodian or owner concerned, and provided that masters of vessels would complete and submit to the Territorial Veterinarian a Shipmaster's Notice concerning any animals carried. Nevertheless, numerous instances of the entry of animals and birds into the Territory, without the knowledge of the Commanding General, Army Port and Service Command, and the Air Quarantine Officer continued to occur.<sup>42</sup> Troops used many methods to hide pets and mascots to avoid complying with quarantine requirements. Circular No. 81, Headquarters Hawaiian Department, Quarantine of Animals and Birds, 1943, had been rescinded with the publication of the Hq. USAFICPA Letter, Quarantine Requirements and Responsibilities. No directive remained in force making a commanding officer responsible for quarantine or destruction of animals or birds illegally entered. To meet this need Section II, Circular No. 58, Hq. USAFICPA, Quarantine of Animals and Birds, dated 15 April 1944 was published. Coincidentally, the Civil Governor published a proclamation placing an embargo against the introduction into the Territory of any animals and birds from all islands in the Pacific Ocean, with the exception of Australia and New Zealand, and from the Continents of Asia and Africa, and islands in the Indian Ocean.<sup>43</sup> Further support was given by Changes No. 2, AR 55-485, dated 7 January 1944, which prohibited the carrying of pets or mascots on U. S. Army transports or vessels wholly allocated to the War Department, or the



carrying of pets or mascots at government expense on other vessels. Later, in 1945, some relaxation of the regulations was necessary for the accommodation of war dogs and seeing-eye dogs for blind veterans. Exceptions to the embargo against importation of dogs from the Pacific Islands, and the 120 day quarantine for dogs imported from the U. S. Mainland were made by the Civil Governor upon the request of the Commanding General, Central Pacific Base Command, specifically for certain war dogs in training, for dogs being returned from war service in the Pacific on discharge to their owners in the Territory, and for seeing-eye dogs of specified veterans. In all instances specified precautionary measures have been required to the complete satisfaction of the Territorial Board of Agriculture and Forestry. These precautions have included surveillance by the Army and Territorial Veterinarians, constant attendance of the dogs, confinement of imported dogs in isolation from local dogs, movement of dogs in insect-proof cages, and quarantine at the Territorial Quarantine Station where possible.

By letter, dated 25 August 1944, the Director, U. S. Public Health Service, District No. 10 (Hawaii) proposed to the Commanding General, USAFPOA, a plan for the integration of quarantine functions performed by the U. S. Army, Navy, and Public Health Service in the Hawaiian area.<sup>44</sup> This letter and the attached plan were forwarded to the Commanding General, Central Pacific Base Command, for remark and recommendation. The USPHS plan brought quarantine procedures in the Hawaiian Department for Navy, Army and civilians under one responsible head and unified control. It was believed that the plan would provide greater efficiency and more adequate safeguards of health in the community. The Commanding General, Central Pacific Base Command, recommended approval of the plan in principle. To date the plan has not been placed in effect by higher headquarters.

Quarantine requirements and responsibilities for all elements of the Central Pacific Base Command have been revised and republished as HCPBC, Administrative Order No. 1, (Index CPYSG 200.50), Quarantine Requirements and Responsibilities, dated 19 March 1945.<sup>45</sup> This directive was written in conformity with AR 40-225, 21 November 1944, and a copy was submitted to The Surgeon General, through channels, as required by paragraph 3(a)(4) of AR 40-225. (No Air Force units are contained within the CPBC.)

At the suggestion of the Chief Quarantine Inspector, U. S. Public Health Service, Honolulu,<sup>46</sup> steps have been taken to spray the interiors of all Army mail and baggage rooms with DDT as a protective measure against the chance introduction into the Territory of insect stowaways in mail and baggage. To implement this procedure HCPBC, Administrative Order No. 1 (Index CPYSG 200.32), Disinsectization of Post Offices and Baggage Rooms, dated 14 August 1945, was published.<sup>47</sup>



Investigation has shown that salvage tires being returned to the U. S. Mainland from the Pacific area have been prolific breeders of mosquitoes, particularly *Aedes aegypti* and *Aedes albopictus*. In many instances these tires are collected in open salvage yards where they become partially filled with water from the rain. Tires are tightly bailed for shipment, but water remains in them. It is also known that *Aedes* mosquito eggs may be laid in the interiors of dry casings to subsequently hatch months later, possibly on the mainland, when water is added. As a preventive measure it has been directed that all salvage tires be treated with DDT insecticide prior to shipment from the Central Pacific Base Command.<sup>48</sup>

To implement Section IV, Circular No. 43, War Department, 1945, a local directive, HCPBC, Administrative Order No. 1, (Index CPYSG 204.90), Permit for Importation of Infectious Agents and Vectors, dated 17 June 1945.<sup>49</sup>

With the establishment of the Central Pacific Base Command, the Surgeon, CPBC, has had only limited jurisdiction over aircraft quarantine,<sup>50</sup> nevertheless close liaison has been maintained with the Air Corps and Air Transport Command on matters of quarantine affecting the CPBC. In June 1945, the Chemical Warfare Officer (Bacteriological Warfare Officer), CPBC, reported that two new insects hitherto foreign to the Hawaiian area had been identified to be present in large numbers during the preceding month, and that 45 live insects had been found on ATC planes arriving on Oahu. One had been found on a NATS plane. This information was transmitted to the Commanding General, Pacific Ocean Areas, by letter on 7 June 1945.<sup>51</sup> More specific information was furnished the Commanding General, POA, on 19 June 1945, including specific information concerning the identification of 6 insects newly established in Hawaii during the preceding months and insects collected upon inspection of Army planes.<sup>52</sup> A continued surveillance of insects collected from aircraft arriving in Hawaii had been maintained since April 1942.<sup>53</sup> In March and April 1945, the Surgeon, CPBC, had recognized inadequacies in the accomplishment of aircraft quarantine procedures and had participated in a survey of all aircraft quarantine techniques on Oahu with representatives of the U. S. Public Health Service, Quarantine Station, Honolulu, the Territorial Board of Agriculture and Forestry; and the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.<sup>54</sup> A copy of the report of this survey, had been sent to the Commanding General, USAFPOA, by the Medical Director, 10th District, U. S. Public Health Service, who had participated in the survey, so that the recommendations might be referred to the Commanding General, Army Air Force Middle Pacific and Commanding General, Pacific Wing, ATC, and Commander, Naval Air Transport Service, calling attention to inadequacies of the present system of disinsectization of aircraft. No further

action has been taken through September 1945.

The history of quarantine as it has affected the Army in the Hawaiian area has shown very significant developments. Basically, quarantine has a different significance for a number of different governmental agencies in the Territory. The U. S. Public Health Service has been primarily concerned with the quarantinable diseases, cholera, plague, smallpox, epidemic typhus, yellow fever, leprosy, anthrax, and psittacosis, with the inspection of ships for these diseases and rodents, with the importing of psittacine, birds, and with the disinsectization of aircraft for the control of mosquitoes. The U. S. Department of Agriculture has been concerned with control of the dissemination of insects, plants, and animals, and plant and animal diseases. The Territorial Board of Agriculture and Forestry has acted in connection with the U. S. Department of Agriculture and has been concerned with the enforcement of Territorial quarantine laws, among them the quarantine of animals liable to rabies. The security which has been necessary in connection with military traffic and the large volume of this traffic has made it necessary for the Army to assume many of the duties of these various agencies for the period of the war. The Army in the Hawaiian area has established quarantine procedures to meet the requirements of each of these agencies to the greatest possible extent. To the Army itself quarantine has had a much broader significance, including all procedures affecting the health of the command in connection with any of the communicable diseases or disease vectors of man or military animals. Many of these problems have been extremely difficult of solution (the quarantine of plants and animals), others have not been solved (perfection in disinsectization of aircraft). Nevertheless, the Army has made great progress during the war and has achieved an integration of the responsibilities of the various different quarantine agencies with its own quarantine needs. The integration of the quarantine activities of the Army with those of the Navy and civilian agencies has been suggested as a function of the U. S. Public Health Service. Instruction has not been received from higher headquarters in this matter, however, such an organization would be handicapped by the limited scope of activity authorized by law for the U. S. Public Health Service in quarantine matters. The Army has had the latitude of power during the war to take such action in connection with quarantine as has been necessary for the successful prosecution of the war and the safeguarding of both military and civilian health.



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